the world's healthiest foods
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The World's Healthiest Foods are health-promoting foods that can change your life.

The George Mateljan Foundation is a not-for-profit foundation with no commercial interests or advertising. Our mission is to help you eat and cook the healthiest way for optimal health.

The World's Healthiest Foods

100 foods that can serve as the basis of your Healthiest Way of Eating. Links to the articles about these foods can be found below. In addition to questions about our foods, we often get asked about beverages and sweeteners. In the beverage category, waterand green tea have been especially popular topics, and in the sweetener category, so have blackstrap molasses, honey and maple syrup.

Of course, there are many other nutritious foods other than those that we have included on our list that we feel are wonderful, health-promoting foods; if there are other whole foods - such as fruits, vegetables, nuts/seeds, whole grains, etc - that you like, by all means enjoy them. Just because a food is not on our list doesn't mean that we don't think that it can be included in a diet geared towards the Healthiest Way of Eating as long as it is a whole, natural, nutrient-rich food.

To find out why some of your favorite nutritious foods are not included in our list, read The Criteria Used to Select the World's Healthiest Foods.

Vegetables

- Asparagus
- Avocados
- Beet greens
- Beets
- Bell peppers
- Bok choy
- Broccoli
- Brussels sprouts
- Cabbage
- Carrots
- Cauliflower
- Celery
- Collard greens
- Corn
- Cucumbers
- Eggplant
- Fennel

- Garlic
- Green beans
- Green peas
- Kale
- Leeks
- Mushrooms, crimini
- Mushrooms, shiitake
- Mustard greens
- Olive oil, extra virgin
- Olives
- Onions
- Potatoes
- Romaine lettuce
- Sea vegetables
- Spinach
- Squash, summer
- Squash, winter
- Sweet potatoes
- Swiss chard
- Tomatoes
- Turnip greens

Fruits

- Apples
- Apricots
- Bananas
- Blueberries
- Cantaloupe
- Cranberries
- Figs
- Grapefruit
- Grapes
- Kiwifruit
- Lemon/Limes
- Oranges
- Papaya
- Pears
- Pineapple
- Plums & Prunes
- Raspberries

- Strawberries
- Watermelon

Seafood

- Cod
- Salmon
- Sardines
- Scallops
- Shrimp
- Tuna

Nuts & Seeds

- Almonds
- Cashews
- Flaxseeds
- Peanuts
- Pumpkin seeds
- Sesame seeds
- Sunflower seeds
- Walnuts

Beans & Legumes

- Black beans
- Dried peas
- Garbanzo beans (chickpeas)
- Kidney beans
- Lentils
- Lima beans
- Miso
- Navy beans
- Pinto beans
- Soy sauce
- Soybeans
- Tempeh
- Tofu

Poultry & Meats

- Beef, grass-fed
- Chicken, pasture-raised
- Lamb, grass-fed
- Turkey, pasture-raised

Eggs & Dairy

- Cheese, grass-fed

- Cow's milk, grass-fed
- Eggs, pasture-raised
- Yogurt, grass-fed

Grains

- Barley
- Brown rice
- Buckwheat
- Millet
- Oats
- Quinoa
- Rye
- Whole wheat

World's Healthiest Herbs & Spices

- Basil
- Black pepper
- Chili pepper, dried
- Cilantro & Coriander seeds
- Cinnamon, ground
- Cloves
- Cumin seeds
- Dill
- Ginger
- Mustard seeds
- Oregano
- Parsley
- Peppermint
- Rosemary
- Sage
- Thyme
- Turmeric

Asparagus

The fleshy green spears of asparagus are both succulent and tender and have been considered a delicacy since ancient times. This highly prized vegetable arrives with the coming of spring, when its shoots break through the soil and reach their 6-8 inch harvest length. In California the first crops are picked as early as February, however, their season generally is considered to run from April through May. The growing season in the Midwest and East extends through July.

What's New and Beneficial about Asparagus

- Recent research has underscored the value of careful storage and speedy consumption of fresh asparagus. The key scientific finding here involves respiration rate. Like all vegetables, asparagus doesn't instantly "die" when it is picked, but instead, continues to engage in metabolic activity. This metabolic activity includes intake of oxygen, the breaking down of starches and sugars, and the releasing of carbon dioxide. The speed at which these processes occur is typically referred to as "respiration rate." Compared to most other vegetables, asparagus has a very high respiration rate. At 60 milligrams of carbon dioxide release per hour per 100 grams of food (at a refrigerator temperature of 41°F), this rate is five times greater than the rate for onions and potatoes; three times greater than the rate for lettuce and tomato; and twice as great as the rate for cauliflower and avocado. Asparagus' very high respiration rate makes it more perishable than its fellow vegetables, and also much more likely to lose water, wrinkle, and harden. By wrapping the ends of the asparagus in a damp paper or cloth towel, you can help offset asparagus' very high respiration rate during refrigerator storage. Along with this helpful step, you will want to consume asparagus within approximately 48 hours of purchase.
- Wild asparagus (*Asparagus racemosus*) is a species of asparagus with a long history of use in India and other parts of Asia as a botanical medicine. Many medicinal qualities of wild asparagus have been associated with phytonutrients present in its roots, and especially one type of phytonutrients called saponins. Recent research has shown that the species of asparagus most commonly consumed in the U.S. (*Asparagus officinalis*) also contains saponins, not only in its root portion put also in its shoots. Saponins found in common, everyday asparagus include asparanin A, sarsasapogenin, and protodioscin. Asparagus even contains small amounts of the diosgenin - one of the best-studied saponins that is especially concentrated in yam. Saponins in food have repeatedly been shown to have anti-inflammatory and anti-cancer properties, and their intake has also been associated with improved blood pressure, improved blood sugar regulation, and better control of blood fat levels.
- You may have heard about two foods — chicory root and Jerusalem artichoke — that are widely recognized as providing health benefits for our digestive tract. These health benefits involve a special area of digestive support called "prebiotics" offered by a compound known as inulin. Both chicory root and Jerusalem artichoke contain rich concentrations of inulin, a unique type of carbohydrate called a polyfructan. Unlike most other carbs, inulin doesn't get broken down in the first segments of our digestive tract. It passes undigested all the way to our large intestine. Once it arrives at our large intestine, it becomes an ideal food source for certain types of bacteria (like *Bifidobacteria* and *Lactobacilli*) that are associated with better nutrient absorption, lower risk of allergy, and lower risk of colon cancer. Researchers now know that asparagus belongs among the list of foods that contain inulin. While approximately 5% lower in inulin than chicory root and Jerusalem artichoke, asparagus is a food that contains a valuable amount of unique carb and may provide our digestive tract with some equally unique health benefits.

Asparagus, cooked
1.00 cup
(180.00 grams)

Calories: 40
GI: very low

Nutrient	DRI/DV
vitamin K	101%
folate	67%
copper	33%
vitamin B1	24%
selenium	20%
vitamin B2	19%
vitamin C	18%
vitamin E	18%
manganese	14%
phosphorus	14%
fiber	14%
potassium	12%
vitamin B3	12%

choline	11%
zinc	10%
vitamin A	10%
iron	9%
protein	9%
pantothenic acid	8%
vitamin B6	8%
magnesium	6%
calcium	4%

Health Benefits

Anti-Inflammatory and Anti-Oxidant Benefits

It's not surprising to see asparagus being heralded as an anti-inflammatory food because it provides a truly unique combination of anti-inflammatory nutrients. Among these anti-inflammatory nutrients are asparagus saponins, including asparanin A, sarsasapogenin, protodioscin, and diosgenin. One of these saponins (sarsasapogenin) has been of special interest in relationship to amyotrophic lateral sclerosis (ALS), also known as "Lou Gehrig's Disease." Even though ALS is classified as a chronic, neurodegenerative disease and is not currently accepted as an autoimmune disorder, excessive, unwanted inflammation may play an important role in the death of certain nerve cells (motor neurons) in ALS. Other anti-inflammatory nutrients in asparagus include the flavonoids quercetin, rutin, kaempferol and isorhamnetin.

Alongside of these anti-inflammatory phytonutrients, asparagus provides a wide variety of antioxidant nutrients, including vitamin C, beta-carotene, vitamin E, and the minerals zinc, manganese, and selenium. In addition to the antioxidant nutrients above, this much-loved vegetable may also contain a valuable amount of the antioxidant glutathione (GSH). GSH is one of the body's best-studied antioxidants; it consists of three amino acids — glutamic acid, glycine, and cysteine — combined into one molecule. At least one published study has estimated the amount of GSH in fresh asparagus to average 28 milligrams per 3.5 ounces. Several studies have compared the overall antioxidant capacity of asparagus to the antioxidant capacity of other vegetables, and the results for asparagus have been impressive. Asparagus compares favorably with many of the cruciferous vegetables like cabbage and cauliflower, and while it ranks lower than some of the green leafy vegetables like spinach, it is still very high on the list of antioxidant foods.

Anti-inflammatory and antioxidant nutrients are some of the best risk reducers we know for common chronic health problems including type 2 diabetes and heart disease. These nutrients are also special risk reducers in the case of certain cancer — a special area of asparagus health benefits that is covered in the following section.

Digestive Support

As described earlier in our "What's New and Beneficial about Asparagus" section, asparagus is unusual as a digestive support food. One key factor in this regard is its inulin content. Like chicory root and Jerusalem artichoke, asparagus contains significant amounts of the nutrient inulin. Inulin is a unique type of carbohydrate called a polyfructan, and in practical terms, healthcare practitioners often refer to it as a "prebiotic." Unlike most other carbs, inulin doesn't get broken down in the first segments of our digestive tract. It passes undigested all the way to our large intestine. Once it arrives at our large intestine, it becomes an ideal food source for certain types of bacteria (like *Bifidobacteria* and *Lactobacilli*) that are associated with better nutrient absorption, lower risk of allergy, and lower risk of colon cancer. While approximately 5% lower in inulin than chicory root and Jerusalem artichoke, asparagus is a food that contains a valuable amount of this unique carb and can help support our digestive health in this unique way.

Alongside of its unusual inulin content, asparagus is rich in fiber (about 3 grams per cup, including about 2 grams of insoluble fiber and 1 gram of soluble fiber) and also contains a noteworthy amount of protein (about 4-5 grams per cup). Both fiber and protein help stabilize our digestion and keep food moving through us at the desirable rate. (By contrast, too much fat can slow down our digestion rate more than desired, and too much sugar or simple starch can speed it up more than desired. We're not surprised to see species of asparagus like *Asparagus racemosus* (commonly known as Shatavari) having a long history of use in treatment of digestive problems in certain healthcare traditions (like ayurvedic medicine), and it makes sense to us that asparagus be considered as a great food for improving digestive support in most diets.

Heart Health and Blood Sugar Regulation

While we have yet to see large-scale dietary studies that examine chronic diseases in humans and asparagus intake, we would expect asparagus intake to show reduced chronic disease risk in two particular areas, namely, heart disease and type 2 diabetes. While there is some preliminary research in both areas, both areas need more attention from asparagus researchers. Our desire to see more research in these areas is based on several factors.

First is the amazing B-vitamin content of asparagus. In our food rating system, asparagus emerges as an excellent source of folic acid, vitamin B1, and vitamin B2 as well as a very good source of niacin, choline, vitamin B6, and pantothenic acid. Because B vitamins play a key role in the metabolism of sugars and starches, they are critical for healthy blood sugar management. And because they play a key role in regulation of homocysteine, they are critical in heart health has well. (Homocysteine is an amino acid, and when it reaches excessive levels in our blood, it is a strong risk factor for heart disease.)

Second, along with its impressive list of B vitamins, asparagus provides us with about 3 grams of dietary fiber per cup, including more than 1 gram of soluble fiber. Intake of soluble fiber has repeatedly been shown to lower our risk of heart disease, and our risk of type 2 diabetes can be significantly lowered as our intake of dietary fiber increases.

Finally, there is the anti-inflammatory/antioxidant factor. Heart disease and type 2 diabetes are both considered chronic diseases that evolve in relationship to chronic, excessive inflammation and oxidative stress. The outstanding antioxidant and anti-inflammatory nutrient composition of asparagus would seem to make it a no-brainer for inclusion as a risk reducer in both of these chronic disease areas. We expect future studies to establish asparagus as a standout for lowering our risk of cardiovascular and blood sugar problems.

Anti-Cancer Benefits

As a result of its very strong anti-inflammatory and antioxidant nutrient composition, we would definitely expect to see a food like asparagus showing up as a risk reducer for certain cancers. Chronic, excessive inflammation and chronic oxidative stress are risk factors for a variety of cancer types, and both unwanted phenomena are related to deficient dietary intake of anti-inflammatory and antioxidant nutrients—exactly the kind of nutrients that are especially plentiful in asparagus. Most of the studies we've seen on the anti-cancer benefits of asparagus have been studies on rats and mice, or studies on specific types of cancer cells. For this reason, we would describe asparagus cancer research as preliminary, and not yet validated by large-scale studies involving humans and dietary intake. But the trends in animal studies and cell studies are clear - asparagus and asparagus extracts can change the metabolic activity of cancer cell types, and these changes are protective in nature and related to better regulation of inflammation and oxidative stress. Cancer cells from the liver are best-studied in this regard.

One confusing area of research on asparagus and cancer involves leukemia. And while this arena has focused upon enzymes related to an amino acid in asparagus, rather than asparagus itself, we thought to include information on it here to clarify this arena for you in case you had come across information on this topic.

Leukemia is a type of cancer involving the bone marrow and its production of white blood cells. In leukemia, white blood cells are not produced in a normal way and do not behave in a normal way, and for these reasons are called leukemia cells. One unusual aspect of leukemia cells is their need to obtain a specific amino acid called asparagine from other cells or from the fluid portion of the blood. If leukemia cells can be prevented from obtaining asparagine, they can sometimes have difficulty surviving. In the mid-1950's and 1960's, researchers discovered that the injection of an enzyme called asparaginase into persons diagnosed with leukemia could sometimes result in decreased levels of blood asparagine in the blood and selective destruction of leukemia cells through asparagine deprivation. Prescription injection of asparaginase enzymes is still used in treatment of acute lymphoblastic leukemia (ALL). Asparagus has become entangled in this fascinating set of events involving leukemia because the name of the amino acid "asparagine" and the name of the enzyme "asparaginase" clearly imply a connection with asparagus. Both the amino acid and the enzyme are present in asparagus, just as their names imply. However, we are not aware of any research showing a treatment connection between leukemia and dietary intake of asparagus. The only research we've seen involves injection of the purified, prescription enzyme medication. In addition, we know that pharmaceutical companies do not use asparagus as a source of the asparaginase enzyme, but rather, rely on bacteria as their enzyme production source.

Description

Asparagus is a perennial garden plant belonging to the Lily family (*Liliaceae*). While approximately 300 varieties of asparagus have been noted, only 20 are edible.

Asparagus, its fleshy spears topped with bud-like compact heads, is often thought of as a luxury vegetable, prized for its succulent taste and tender texture. It is harvested in the spring when it is 6 to 8 inches tall. While the most common variety of asparagus is green in color, two other edible varieties are available. White asparagus, with its more delicate flavor and tender texture, is grown underground to inhibit its development of chlorophyll content, therefore creating its distinctive white coloring. It is generally found canned, although you may find it fresh in some select gourmet shops, and it is generally more expensive than the green variety since its production is more labor intensive. The other edible variety of asparagus is purple in color. It features a fruitier flavor and also provides benefits from phytonutrients called anthocyanins that give it its purple color. With prolonged cooking, the purple color may disappear.

History

Asparagus has been prized as an epicurean delight and for its medicinal properties for almost 2000 years. Its presence across most continents is partly due to its many different species. Some of these species — like *Asparagus officinalis* — are widely cultivated and consumed as staple foods. Other species - like Asparagus racemosus, widely found in India and the Himilayas - have been used in a more medicinal context. In the case of *Asparagus racemosus*, also known as Shatavari, there is a long history of use in Ayurvedic medicine, especially in relationship to digestive problems. Various species of asparagus were cultivated by Egyptian cultures beginning as early as 3000 B.C., and by European cultures including early Greek and Roman cultures. Asparagus also became particularly popular in France during the 18th century during the rule of Louis XIV. In terms of commercial production, China (587,500 tons) and Peru (186,000 tons) are currently the world's largest producers and exporters of asparagus. Next in line as commercial producers are the United States (102,780 tons) and Mexico (67,247 tons).

How to Select and Store

Since asparagus varieties most commonly available in the U.S. are green in color, you are most likely to find these green-colored varieties in your grocery store. However, asparagus growers are able to take these same varieties of asparagus, pile dirt on top of the shoots when they start to poke through the ground, and then allow the shoots to continue growing beneath the dirt. This process prevents sunlight from falling on the shoots and results in asparagus shoots that are white in color. While you are most likely to find white asparagus in canned form, you can also find it fresh in some select gourmet shops, and it is generally more expensive than the green variety. Other varieties of asparagus can be purple in color. These varieties typically have a higher sugar content than green and white varieties and for this reason have a sweeter taste. (Of course, even with this higher sugar content, asparagus is anything but a high-sugar food. We're talking about 3 grams of total sugar per cup of fresh asparagus — less than half of the amount in an extra small apple.)

Asparagus stalks should be rounded, and neither fat nor twisted. Look for firm, thin stems with deep green or purplish closed tips. The cut ends should not be too woody, although a little woodiness at the base prevents the stalk from drying out. Once trimmed and cooked, asparagus loses about half its total weight. Use asparagus within a day or two after purchasing for best flavor and texture.

Store in the refrigerator with the ends wrapped in a damp paper towel. Loss of some nutrients in asparagus—for example, its vitamin C content—is likely to be slowed down through refrigeration.

How to Enjoy

A Few Quick Serving Ideas

- Add cold asparagus to your favorite salad.
- Toss freshly cooked pasta with asparagus, olive oil and your favorite pasta spices. We especially enjoy thyme, tarragon and rosemary.
- Chopped asparagus make a flavorful and colorful addition to omelets.
- Healthy saute asparagus with garlic, shiitake mushrooms and tofu or chicken for a complete meal.

WHFoods Recipes That Feature Asparagus

- Garlic Shrimp Salad
- Mediterranean Pasta Salad
- Steamed Salmon and Asparagus with Mustard Dill Sauce
- Stir-Fried Seafood with Asparagus
- 15-Minute Healthy Sauteed Chicken & Asparagus
- 15-Minute Healthy Sauteed Asparagus and Tofu
- Miso Stir-Fry
- Primavera Verde

- 5-Minute Healthy Sauteed Asparagus
- Warm Asparagus Salad

Safety

Contrary to popular belief, persons who experience a strong odor coming from their urine after eating asparagus are not in any danger from eating this vegetable. Their urine odor following consumption of asparagus is a far more complicated issue than you might expect. Several dozen studies in this area have failed to come up with any simple explanation of this asparagus and urine odor phenomenon.

Two major factors are clearly involved in asparagus and urine odor: one factor is a person's ability to produce odor-emitting substances from asparagus. There is little agreement among studies in this regard, primarily because researchers are not in agreement about which asparagus-derived substances actually produce the odor. At least 21 different substances have been proposed as the odor-producing substances from asparagus! Some studies indicate that very few people metabolize asparagus in such a way as to generate odor-producing substances. Other studies indicate that two out of every three people produce such substances. A second factor involved with asparagus and urine odor is a person's ability to perceive odors. In some studies, 50% of all study participants appear unable to perceive odors in urine from asparagus. To make matters even more complicated, there does not appear to be any patterned relationship between a person's ability to generate odor-producing substances from asparagus and a person's ability to perceive asparagus-related odors. There are very likely to be genetic tendencies involved with both production of odor-related substances from asparagus and perception of those substances, but detection of genetic tendencies (called genetic polymorphisms) remains incomplete. (In the case of odor perception, however, some research is beginning to point to a single nucleotide polymorphism, rs4481887, as being associated with the inability to smell odor-related substances from asparagus.)

Despite the many remaining mysteries about urine odor and asparagus, no research studies have suggested a link between asparagus consumption, urine odor, and health risk. There are no studies to indicate that a strong urine odor from asparagus is a reason for us to exclude asparagus from our diet or that health benefits from asparagus vary along with the presence or absence of urine odor. If you detect a strong urine odor following consumption of asparagus, and you're concerned about this odor, you can obviously avoid consumption asparagus in your diet. But from a research standpoint, you will also be missing out on the health benefits of this unique food.

Substances Associated with the Urine Odor from Asparagus

- methanethiol
- 1-propene-3-isothiocyanate
- 3-methylthiophene
- bis-(methythio)methane
- carbon disulfide
- carbon oxide sulfide
- dimethyl disulfide
- dimethyl sulfide
- dimethyl sulfone
- dimethyl sulfoxide
- dimethyl trisulfide
- E-methylthio-1-propene
- hydrogen sulfide
- Methylpropylsulfide
- S-methyl-2-propenthioate
- S-methyl-thioacrylate
- Tetrahydrothiophene
- methanesulfonic anhydride
- butyrolactone
- 1,4-bis(methythio)-butane
- S-methyl-3-(methythio)thiopropionate

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Asparagus, cooked **1.00 cup** **180.00 grams**				**Calories: 40** **GI: very low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin K	91.08 mcg	101	46.0	excellent
folate	268.20 mcg	67	30.5	excellent
copper	0.30 mg	33	15.2	excellent
vitamin B1	0.29 mg	24	11.0	excellent
selenium	10.98 mcg	20	9.1	excellent
vitamin B2	0.25 mg	19	8.7	excellent
vitamin C	13.86 mg	18	8.4	excellent
vitamin E	2.70 mg (ATE)	18	8.2	excellent
fiber	3.60 g	14	6.5	very good
manganese	0.28 mg	14	6.4	very good
phosphorus	97.20 mg	14	6.3	very good
vitamin B3	1.95 mg	12	5.5	very good
potassium	403.20 mg	12	5.2	very good
choline	46.98 mg	11	5.0	very good
vitamin A	90.54 mcg RAE	10	4.6	very good
zinc	1.08 mg	10	4.5	very good
iron	1.64 mg	9	4.1	very good
protein	4.32 g	9	3.9	very good
vitamin B6	0.14 mg	8	3.7	very good
pantothenic acid	0.40 mg	8	3.6	very good
magnesium	25.20 mg	6	2.9	good
calcium	41.40 mg	4	1.9	good

World's Healthiest Foods Rating	**Rule**
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Avocados

What's New and Beneficial About Avocados

- Many of our WHFoods provide you with carotenoids. These orange-yellow pigments offer you outstanding health benefits—but only if they are absorbed up into your cells. Intake of fat along with carotenoids greatly helps to improve their absorption. However, many of our best foods for obtaining carotenoids—for example, sweet potatoes, carrots, and leafy greens—contain very little fat (less than 1 gram per serving). As a special step for improving carotenoid absorption from carotenoid-rich foods, researchers have experimented with the addition of avocado to meal choices including salads, side servings of leafy greens, side servings of carrots, or tomato sauce. The amount of avocado added has varied from study to study but averages approximately 1 cup or 1 small/medium avocado providing 20-25 grams of total fat. As expected, this added avocado has been shown to increase carotenoid absorption from all of the foods listed above. Anywhere from two to six times as much absorption was found to occur with the added avocado! But in addition to this increased absorption was a much less anticipated result in a recent study: not only did avocado improve carotenoid absorption, but it also improved conversion of specific carotenoids (most importantly, beta-carotene) into active vitamin A. (This unexpected health benefit of increased conversion was determined by the measurement of retinyl esters in the bloodstream of participants, which were found to increase after consumption of carrots or tomato sauce in combination with avocado.)

  Avocados do contain carotenoids, in and of themselves. And thanks to their fat content, you can get good absorption of the carotenoids that they contain. However, if you happen to be consuming an avocado-free meal or snack that contains very little fat yet rich amounts of carotenoids, some added avocado might go a long way in improving your carotenoid absorption and vitamin A nourishment. Salad greens—including romaine lettuce—and mixed greens like kale, chard, and spinach are great examples of very low fat, carotenoid-rich foods that might be eaten alone but would have more of their carotenoid-richness transferred over into your body with the help of some added avocado.

- The method you use to peel an avocado might make a difference to your health. Research on avocado shows that the greatest phytonutrient concentrations occur in portions of the food that we do not typically eat, namely, the peel and the seed (or "pit.") The pulp of the avocado is actually much lower in phytonutrients than these other portions of the food. However, while lower in their overall phytonutrient richness, all portions of the pulp are not identical in their phytonutrient concentrations and the areas of the pulp that are closest to the peel are higher in certain phytonutrients than more interior portions of the pulp. For this reason, you don't want to slice into that outermost, dark green portion of the pulp any more than necessary when you are peeling an avocado. Accordingly, the best method is what the California Avocado Commission has called the "nick and peel" method. In this method, you actually end up peeling the avocado with your hands in the same way that you would peel a banana. The first step in the nick-and-peel method is to cut into the avocado lengthwise, producing two long avocado halves that are still connected in the middle by the seed. Next you take hold of both halves and twist them in opposite directions until they naturally separate. At this point, remove the seed and cut each of the halves lengthwise to produce long quartered sections of the avocado. You can use your thumb and index finger to grip the edge of the skin on each quarter and peel it off, just as you would do with a banana skin. The final result is a peeled avocado that contains most of that dark green outermost flesh, which provides you with the best possible phytonutrient richness from the pulp portion of the avocado.
- Recent research on avocado and heart disease risk has revealed some important health benefits that may be unique to this food. Avocado's reputation as a high-fat food is entirely accurate. Our 1-cup website serving provides 22 grams of fat, and those 22 grams account for 82% of avocado's total calories. And they do not necessarily provide a favorable ratio of omega-3 to omega-6 fat; you get less than 1/4 gram of omega-3s from one serving of avocado and 2.5 grams of omega-6s, for a ratio of 10:1 in favor of omega-6s. However, despite these characteristics, the addition of avocado to already well-balanced diets has been shown to lower risk of heart disease, improve blood levels of LDL, and lower levels of oxidative stress in the bloodstream following consumption of food. In one particular research study, participants in two groups all consumed a diet with the same overall balance, including 34% fat in both groups. But one avocado per day was included in the meal plan of only one group, and that was the group with the best heart-related results in terms of blood fat levels.

  Most researchers are agreed that the high levels of monounsaturated fat in avocado—especially oleic acid—play a role in these heart-related benefits. Nearly 15 out of the 22 grams of fat (68%) found in one cup of avocado come from monounsaturated fat. (And by contrast, less than 3 grams come from the category of polyunsaturated fat, which includes both omega-6s and omega-3s.) This high level of monounsaturates puts avocado in a similar category with olives, which provide about 14 grams of fat per cup and approximately 73% of those grams as monounsaturates. In addition to its high percentage of monounsaturated fat, however, avocado offers some other unique fat qualities. It provides us with phytosterols including beta-sitosterol, campesterol, and stigmasterol. This special group of fats has been shown to provide important anti-inflammatory benefits to our body systems, including our cardiovascular system. Not as clear from a dietary standpoint are the polyhydroxylated fatty alcohols, or PFAs, found in avocado. PFAs are a group of fat-related compounds more commonly found in sea plants than in land plants, making the avocado tree unusual in this regard. However, the studies that we have seen on PFAs and avocado have extracted these PFAs from the seed (or pit) of the fruit, rather than the pulp. Since we typically do not consume this part of the avocado, the practical role of these PFAs from a dietary standpoint is less clear than the role of monounsaturates and phytosterols described above.

- Recent studies have analyzed the overall impact of avocado on the average U.S. diet, with some fascinating results. In one broad-based, national study, all participants who reported eating *any* avocado during the last 24 hours were compared to all participants who reporting eating *no* avocado during that same time period. The avocado-eating U.S. adults were found to have greater fiber intake (over 6 grams more for the day); greater potassium intake (439 milligrams more); greater vitamin K intake (57 micrograms more); and greater vitamin E intake (2.2 milligrams alpha-tocopherol equivalents more) than U.S. adults who ate no avocado. Interestingly, all of the nutrients listed above are nutrients for which avocado receives a rating of "good" on our WHFoods nutrient rating system! It's worth adding here that U.S. adults consuming avocado also averaged 43 milligrams more magnesium, 5.6 grams more monounsaturated fat, and 3.2 grams more polyunsaturated fat. The study authors also noted that avocado eating was associated with better overall diet quality, as well as better intake of vegetables and fruits as a whole.

Avocado, cubed, raw
1.00 cup
(150.00 grams)

Calories: 240
GI: very low

Nutrient	DRI/DV
pantothenic acid	42%
fiber	40%
vitamin K	35%
copper	31%
folate	30%
vitamin B6	23%
vitamin E	21%
potassium	21%
vitamin C	20%

Health Benefits

Broad-Based Nutritional Support

As described earlier in our "What's New and Beneficial" section, U.S. adults who consume avocado average some important nutrient benefits, including intake of more potassium, vitamin K, vitamin E, fiber, magnesium, and monounsaturated fat. In addition, they average greater overall intake of fruits and vegetables and have better overall diet quality. Due to their higher calorie content, avocados do not rank as high in our rating system as do other nutrient-rich foods with fewer calories. However, there are very few DRI vitamins or minerals not found in avocado! In this food you will find all B vitamins except vitamin B12; vitamin C (at 20% of our WHFoods recommended daily level in one cup); phosphorus, manganese, and copper at more than 10% of our WHFoods recommendation); and 8% of our recommended daily omega-3s.

In addition to these conventional nutrients, avocados offer a wide range of phytonutrients that are related to their unusual fat quality. Included in this category are the phytosterols (beta-sitosterol, campesterol, and stigmasterol) as well as their polyhydroxylated alcohols. The major carotenoid found in the pulp of avocado is chrysanthemaxanthin. Other carotenoids in the pulp include neoxanthin, transneoxanthin, neochrome, and several forms of lutein. As mentioned earlier, avocado is also an especially rich source of monounsaturated fatty acids, and in particular, oleic acid, which accounts for over 60% of the total fat found in this food.

It would be wrong to conclude this nutritional support section without mentioning the improved absorption of carotenoids that can take place when very low-fat, carotenoid-rich food might otherwise be consumed in the absence of fat. As described earlier in our What's New and Beneficial section, many of our best foods for obtaining carotenoids—for example, sweet potatoes, carrots, and leafy greens—contain very little fat (less than 1 gram per serving). This absence of fat works against their absorption into the body, and the addition of a fat-containing food like avocado can change this situation pretty dramatically. Anywhere from two to six times as much absorption of carotenoids has been found to occur in these very low-fat, high carotenoid dietary situations. In addition, the combination of carotenoid-rich, very low-fat foods like carrots with a high-fat food like avocado has been shown to improve conversion of specific carotenoids (most importantly, beta-carotene) into active vitamin A. We think about this avocado health benefit as another component of its broad-based nutritional support.

Cardiovascular Support

Numerous studies have looked at the relationship between avocado consumption and blood fat levels, types of fat in the bloodstream, inflammatory risk in the cardiovascular system, and degree of cardiovascular protection against oxygen-based damage. The study results are consistent in showing benefits from avocado in all of these areas. Most of the benefits are associated with avocado consumption at least multiple times per week in amounts of approximately one cup. (Depending on the variety, one cup of avocado is approximately the same as the amount of pulp found in one small-to-medium sized avocado. Some studies also show benefits with smaller amounts of avocado in the 1/2-cup range.

A wide range of nutrients in avocado has been associated with these cardiovascular benefits. Included in this list would be: (1) avocado fats, which include very large amounts of the monounsaturated fatty acid, oleic acid, as well as the unusual phytosterols, including beta-sitosterol, campesterol, and stigmasterol; (2) the antioxidant nutrients in avocado, including carotenoids like chrysanthemaxanthin, neoxanthin, and lutein as well as vitamin E and vitamin C; (3) anti-inflammatory components of avocado, including the carotenoids and phytosterols listed above as well as catechins and procyanidins (two families of flavonoids).

Risk of metabolic syndrome—which includes symptoms involving problematic blood fat levels and elevated blood pressure—has been shown to be reduced by intake of avocado. Many of the nutrients provided by avocado are likely to play a role in this important health benefit. Research in this area encourages us to think about avocado as being truly preventive in its cardiovascular health benefits, and worthy of consideration in many types of meal plans.

One important note about the cardiovascular benefits of avocado: most of the encouraging studies that we have seen do not simply "dump" avocado into a meal plan as some type of "add-on" food. Instead, avocado is integrated into a balanced diet with a controlled amount of fat, calories, and intake across food groups. There does not appear to be any requirement for the diet to be low fat, since avocado-containing meal plans that provide up to 34% of their total calories from fat have been shown to provide cardiovascular support. But treatment of avocado as an "add-on" food is not an approach that we have seen supported by large-scale research in this cardiovascular area.

Other Health Benefits

We believe that avocado is likely to provide you with health benefits in the areas of blood sugar control, insulin regulation, satiety and weight management, and decreased overall risk of unwanted inflammation. However, we would still like to see further expansion of research findings in these areas. With respect to blood sugar and insulin regulation, we have seen smaller scale studies showing reduced insulin secretion after a meal and improved regulation of blood sugar levels, but most of these studies have focused on the short-term situation following a meal rather than extended blood sugar regulation over weeks or months. Some of these studies have focused on the fiber content of avocado, which is more substantial than many people might think. (There are 10 grams of fiber in our one cup website serving.) Also investigated in this area has been the 7-carbon sugar called mannoheptulose (and its polyol form called perseitol). This sugar—unlike most sugars—may help suppress insulin secretion.

In the area of satiety and weight management, we've seen studies showing improved feelings of fullness and satisfaction after eating a meal that contained avocado, as well as decreased body mass index (BMI) and total body fat after six weeks of consuming a meal plan that contained 1.3 cups of avocado per day. However, we would also immediately note that participants in this study were required to follow a balanced meal plan with a restricted number of calories (about 1,700 calories per day). So we suspect that avocado can indeed be helpful to include in a weight management plan, but only if the overall plan is well thought out and takes the overall amount of food intake into consideration.

Avocado has clearly been shown to provide a wide variety of antioxidant and anti-inflammatory nutrients. Included here are both conventional nutrients like manganese, vitamin C, and vitamin E, as well as phytonutrients like unique carotenoids, flavonoids, and phytosterols. Most of the larger scale, human research studies that we have seen focus on the cardiovascular system and risk of oxidative stress and inflammation in this system. In terms of the whole body, however, and its many key physiological systems, the antioxidant and anti-inflammatory benefits of avocado have been tested primarily in the lab or in animal studies. For example, numerous animal studies have looked at the impact of avocado intake on risk of inflammation in connective tissue and have speculated about the potential benefits of avocado for reducing human arthritis risk. Because of the promising nature of these preliminary studies, we look forward to new research involving large numbers of human participants and intake of avocado in a weekly meal plan.

Description

Optimally ripe avocados are typically known for their silky, creamy texture and rich flavors (which some people describe as "nutty" or "nut-like"). Avocados owe their creamy texture to their high fat content. (The Hass avocado that we analyzed for nutrient content on our website contained 22 grams of fat per cup and provided 82% of its total calories in the form of fat.) Not all avocados are identical in terms of fat content, however. As a general rule, smaller sized avocados tend to be more oily and higher in fat, and large sized avocados tend to be somewhat less oily and lower in fat percentage.

All avocado belong to the science genus/species group called Persea americana. Over 50 different commercial varieties of avocado exist within this basic group. Avocados are also often categorized as belonging to three basic types (sometimes called "races") according to their place of origin. West Indian avocados originated in tropical lowlands and subtropics, including countries like Cuba, Jamaica, Haiti, the Dominican Republic, Puerto Rico, and others. The science name *Persea americana Mill. var. Americana* is often used to refer to West Indian avocado. A second category of avocado is Guatemalan avocado, originating as the name suggests in the country of Guatemala. The science names used for Guatemalan avocado are usually *Persea americana var guatemalensis* or *Persea americana var. nubigena*. A third category of avocado is Mexican avocado, originating in Mexico. Here the science name is often *Persea americana var drymifolin*. In practice, you will hear many different varieties of avocado being referred to as "Mexican avocados" or "Guatemalan avocados" or "West Indian avocado" even though they were not actually grown in those countries and only have ancestral origins there.

Because Mexico is the world's largest producer and exporter of avocados, and because demand for avocados within the United States has increased steadily since the 1980's, many avocados grown in Mexico find their way into U.S. supermarkets. Within the U.S., California and Florida are the primary avocado-producing states, with about six times the total number of avocados being produced in California compared to Florida. Seven commercial varieties of avocado are produced on a large-scale basis in California, but the Hass variety accounts for about 95% of all California production. It is also worth noting that a sizeable number of avocados are imported by the U.S. from South American countries including Chile, Columbia, Peru, and Brazil.

Due to hybridization, cross seedlings, and several thousand years of avocado cultivation, it has become very difficult to take the common name for a common avocado variety—for example, Fuerte—and link it up with a specific place of origin. Fuerte is a good example because this variety is a Mexican-Guatemalan cross. But it may have been commercially grown either inside or outside of the U.S. And while we think about Hass avocados coming from California versus Florida, there are "Florida Hass" varieties as well. Lulu, Taylor, Booth, Choquette, Lamb, Ettinger, Brogden, Zutano, Reed, Pinkerton, Gwen, Bacon, Donnie, Simmonds, Dupuis, Gainesville, and Mexicola are some of the other common variety names for avocados that you may come across in the marketplace. However, rather than relying on the common name of an avocado to determine its actual growing location, you will need to check the country of origin sticker or ask the produce manager.

History

As mentioned above in our Description section, avocados are often categorized according to the ancestral origins in the West Indies, Guatemala, or Mexico. In fact, avocados were also native to other parts of Central and South America, where they have been cultivated for food use for several thousand years.

In today's marketplace, the largest producers of avocados are Mexico, Chile, the United States, Indonesia, the Dominican Republic, Columbia, Peru, Brazil, China, and Guatemala. Mexico is an especially large exporter of avocado into the U.S., with about 500,000 metric tons of avocado being sent from Mexico to the U.S. each year. About 200,000 tons of avocado are produced in the state of California each year, and another 35,000 tons in the state of Florida.

As a result of the above global production, you are most likely to find avocados in the supermarket that were grown either in Mexico, California, Florida, or a Central American or South American country. Because of the greater total volume and slightly longer marketing season, you are also more likely to find California versus Florida avocados in the supermarket among domestic varieties.

How to Select and Store

A ripe, ready-to-eat avocado is slightly soft but should have no dark sunken spots or cracks. If the avocado has a slight neck, rather than being rounded on top, it may have ripened a bit more on the tree and have a richer flavor. A firmer, less mature fruit can be ripened at home and may be less likely to have bruises, depending on how it was handled during harvest and transport. The average California Hass avocado weighs between 165-170 grams (about 6 ounces) and has a pebbled dark green or black skin. Other varieties can have different textures (for example, smoother and less pebbly), different colors (for example, lighter or brighter greens), and varying degrees of glossiness.

A firm avocado will ripen in a paper bag or in a fruit basket at room temperature within a few days. As the fruit ripens, the skin will turn darker. However, we do not recommend relying exclusively on color to determine the ripeness of an avocado. Hold the avocado very gently in your palm and begin to press very gently against its surface. A ripe avocado will yield to very gentle pressure, without feeling squishy.

Avocados should not be refrigerated until they are ripe. Once ripe, they can be kept refrigerated for up to a week. Loss of some nutrients in avocado—for example, its vitamin C content—is likely to be slowed down through refrigeration. If you are refrigerating a whole avocado, it is best to keep it whole and not slice it in order to avoid browning that occurs when the flesh is exposed to air.

If you have used a portion of a ripe avocado, it is best to store the remainder in the refrigerator. Store in a sealed and reusable glass container or sealed and reusable plastic container. Sprinkling the exposed surface(s) with lemon juice will help to prevent the browning that can occur when the flesh comes in contact with oxygen in the air.

How to Enjoy

A Few Quick Serving Ideas

- Use chopped avocados as a garnish for black bean soup.
- Add avocado to your favorite creamy tofu-based dressing recipe to give it extra richness and a beautiful green color.
- Mix chopped avocados, onions, tomatoes, cilantro, lime juice and seasonings for a rich-tasting twist on traditional guacamole.
- Spread ripe avocados on bread as a healthy replacement for mayonnaise when making a sandwich.
- For an exceptional salad, combine sliced avocado with fennel, oranges and fresh mint.
- For a beautiful accompaniment to your favorite Mexican dish, top quartered avocado slices with corn relish and serve with a wedge of lime.

WHFoods Recipes That Feature Avocados

- 10-Minute Huevos Rancheros
- Breakfast Bagel
- Poached Huevos Rancheros
- 15 Minute Shrimp and Avocado Salad
- 15 Minute Turkey Chef's Salad
- Healthy Veggie Salad
- Mexican Cheese Salad
- Salmon, Cucumber, Dill Salad
- 15-Minute Halibut with Avocado Salsa
- Southwestern Salmon & Black Beans
- Romaine and Avocado Salad

Safety

Avocados and Latex-Fruit Syndrome

Latex-fruit syndrom is a health problem related to the possible reaction of our immune system to certain proteins found in natural rubber (from the tree *Hevea brasiliensis*) and highly similar proteins found in certain foods, such as avocados. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating.

Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

<table>
<tr><th colspan="3">Avocado, cubed, raw
1.00 cup
150.00 grams</th><th colspan="2">Calories: 240
GI: very low</th></tr>
<tr><th>Nutrient</th><th>Amount</th><th>DRI/DV (%)</th><th>Nutrient Density</th><th>World's Healthiest Foods Rating</th></tr>
<tr><td>pantothenic acid</td><td>2.08 mg</td><td>42</td><td>3.1</td><td>good</td></tr>
<tr><td>fiber</td><td>10.05 g</td><td>40</td><td>3.0</td><td>good</td></tr>
<tr><td>vitamin K</td><td>31.50 mcg</td><td>35</td><td>2.6</td><td>good</td></tr>
<tr><td>copper</td><td>0.28 mg</td><td>31</td><td>2.3</td><td>good</td></tr>
<tr><td>folate</td><td>121.50 mcg</td><td>30</td><td>2.3</td><td>good</td></tr>
<tr><td>vitamin B6</td><td>0.39 mg</td><td>23</td><td>1.7</td><td>good</td></tr>
<tr><td>potassium</td><td>727.50 mg</td><td>21</td><td>1.6</td><td>good</td></tr>
<tr><td>vitamin E</td><td>3.11 mg (ATE)</td><td>21</td><td>1.6</td><td>good</td></tr>
<tr><td>vitamin C</td><td>15.00 mg</td><td>20</td><td>1.5</td><td>good</td></tr>
</table>

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Beet greens

When purchasing fresh beets in the produce section of your grocery, you are very likely to find them bunched together with their colorful leafy greens adorning their tops. While many people can cut off these greens and only consume their round root portion, beet greens are actually the most nutrient-rich part of the plant and provide amazing health benefits.

What's New and Beneficial About Beet Greens

- A recent study from Chile has shown beet greens to be one of the top 10 food contributors to iron intake in that country. Even though legumes were the most important food group contributor to iron (with pinto beans ranking as the number one food source), beet greens were nevertheless a standout source, especially within the vegetable group. (Our WHFoods rating system ranks beet greens as a very good source of iron, providing 15% of the daily recommended amount in a 1-cup serving.)
- Dark green leafy vegetables (DGLV) are often lumped together as a group and treated interchangeably. However, up-to-date nutrient information reveals important differences between members of this incredibly nutrient-rich food group. For example, when beet greens are compared with two other common DGLVs—turnip greens and mustard greens—only beet greens provide excellent amounts of both calcium and magnesium, While all three of these DGLVs provide excellent amounts of calcium, only beet greens also provide an excellent amount of magnesium at 98 milligrams per serving, or nearly 25% of the recommended daily amount. This unique aspect of beet greens gives them a calcium:magnesium ratio of 1.6:1, in comparison to the ratio in turnip greens of 6.2:1, or the ratio in mustard greens of 9.2:1.
- Both beet greens and beet roots can provide you with outstanding nourishment. The roots are especially concentrated in folate, providing 5-6 times the amount of this vitamin as the leaves. However, from an overall nutritional perspective, beet greens achieve 11 rankings of excellent, 6 rankings of very good, and 3 rankings of good in our WHFoods rating system, for a total of 20 rankings. (By comparison, beet roots achieve a total of 10 rankings.) This outcome places beet greens in our Top 10 foods in terms of total rankings.
- A recent study has shown beet greens to be a major contributor in many diets to total intake of the carotenoids lutein and beta-carotene. While not as concentrated in lutein as collard greens or spinach, beet greens have nevertheless been shown to be an outstanding source of this key carotenoid. (Lutein is known to play an especially important role in eye health, including the health of the retina.)

WHFoods Recommendations

Foods belonging to the chenopod family—including beets, chard, spinach and quinoa—continue to show an increasing number of health benefits not readily available from other food families. The red and yellow betalain pigments found in this food family, their unique epoxyxanthophyll carotenoids, and the special connection between their overall phytonutrients and our nervous system health (including our specialized nervous system organs like the eye) point to the chenopod family of foods as unique in their health value. While we have yet to see large-scale human studies that point to a recommended minimum intake level for foods from this botanical family, we have seen data on chenopod phytonutrients, and based on this data, we recommend that you include foods from the chenopod family in your diet 1-2 times per week. In the case of a leafy food like spinach, we recommend a serving size of at least 1/2 cup, and even more beneficial, at least one full cup. In the case of a root food like beet root, we recommend a serving size of at least 1/2 whole medium beet, and even more beneficial, at least 1 whole medium beet. For quinoa, our recommended minimum serving size is 1/2 cup pre-cooked.

Beet Greens, boiled
1.00 cup
(144.00 grams)

Calories: 39
GI: not available

Nutrient	DRI/DV
vitamin K	774%
vitamin A	61%
vitamin C	48%
copper	40%
potassium	37%
manganese	37%
vitamin B2	32%
magnesium	24%
vitamin E	17%

fiber	17%
calcium	16%
iron	15%
vitamin B1	14%
vitamin B6	11%
pantothenic acid	9%
phosphorus	8%
protein	7%
zinc	7%
vitamin B3	5%
folate	5%

Health Benefits

Unusually Comprehensive Nourishment

As mentioned earlier in this profile, beet greens achieve 20 rankings of excellent, very good, or good in our WHFoods rating system. These results place beet greens among our Top 10 ranked foods. Equally important, no major category of nutrients is left out of these high ratings. In the macronutrient category, beet greens are an excellent source of fiber and a very good source of protein. In the vitamin category, they are an excellent source of both fat-soluble vitamins like vitamins A and K, as well as water-soluble vitamins like vitamins C and B2. In the mineral category, they are an excellent source of 5 minerals, including copper, potassium, manganese, magnesium, and calcium. In fact, when beet greens are compared with two other common dark green leafy vegetables (DGLV)—turnip greens and mustard greens—only beet greens provide excellent amounts of both calcium and magnesium. While all three of these DGLVs provide excellent amounts of calcium, only beet greens also provide an excellent amount of magnesium at 98 milligrams per serving, or nearly 25% of the recommended daily amount. This unique aspect of beet greens gives them a calcium:magnesium ratio of 1.6:1, in comparison to the ratio in turnip greens of 6.2:1, or the ratio in mustard greens of 9.2:1. The ratio in beet greens may be more helpful to the average U.S. adult than the ratio in these other greens, since the average U.S. adult is more deficient in magnesium than calcium.

In the phytonutrient category, beet greens show special benefits in the area of carotenoid richness. We rank them as an excellent source of vitamin A due to their rich concentration of beta-carotene and lutein. Beet greens have been shown to be a major contributor in many diets to total intake of the carotenoids lutein and beta-carotene. While not as concentrated in lutein as collard greens or spinach, beet greens have nevertheless been shown to be an outstanding source of this key carotenoid. Lutein is known to play an especially important role in eye health, including the health of the retina.

Other Health Benefits

Unfortunately, few studies have tried to separate out health benefits specific to beet greens from health benefits associated with intake of dark green leafy vegetables (DGLVs) as a group. Without question, increased intake of DGLVs has been associated in large-scale, epidemiologic studies with lower risk of certain chronic diseases, including type 2 diabetes, high blood pressure, cardiovascular disease, and stroke. Based on the most recent report from the World Cancer Research Fund and American Institute for Cancer Research (WCFR/AICR), we also believe there is evidence in support of decreased risk of certain cancers following generous intake of DGLVs. While we fully expect to see these health benefits coming from intake of beet greens as such, we also look forward to future research where beet green intake is analyzed independently from intake of other DGLVs.

Description

Both beets and Swiss chard are different varieties within the same plant family (*Amaranthaceae-Chenopodiaceae*) and their edible leaves share a resemblance in both taste and texture. All varieties of table beets have edible leaves that are primarily green in color. However, the veins in these beet greens tend to take on the color of the beet root. For this reason, you will find beet greens from yellow beets with vibrant yellow veins, beet greens from red beets having rich red veins, and beet greens from white beets with distinct white veins. Each of these greens can make an outstanding contribution to your health.

The similarity between beets greens and Swiss chard does not stop with their plant family, taste, or texture. At WHFoods, we use a quick boil for both foods to help preserve their nutrient richness during cooking. In addition, both foods achieve of 20 rankings of excellent, very good, or good in our rating system!

The science name for the beet plant is *Beta vulgaris*. There are several subspecies of beets within this scientific category, including the subspecies *vulgaris*, *macrocarpa*, *crassa*, and *maritime*. The greens attached to the beet roots are delicious and can be prepared like spinach or Swiss chard. They are incredibly rich in nutrients, concentrated in vitamins and minerals as well as carotenoids such as beta-carotene and lutein/zeaxanthin.

While beets are available throughout the year, their season runs from June through October when the youngest, most tender beets are easiest to find.

History

Beet greens have been enjoyed in cuisines worldwide since prehistoric times, especially in Northern Africa, Asia, and parts of Europe. Today, of course, they are enjoyed worldwide.

From a commercial production standpoint, beets fall into three basic categories: table beets, which are grown primarily for consumption as fresh vegetables; sugar beets, which are grown primarily for the extraction of beet sugar; and fodder beets, which are grown primarily for use in animal feed. From a practical standpoint, one of the key differences that has emerged between sugar beets and table beets involves the role of genetic engineering. The vast majority of all sugar beets grown worldwide involve genetically modified versions of the plants. This extensive use of genetic engineering does not exist to the same degree for table beets, and organic table beets (and beet greens) are widely available in the marketplace with USDA certification as having been grown from seeds that have not been genetically engineered. It is also worth noting here that when used as feed for the raising of animals providing certified organic meats, milks, cheeses, and other foods, fodder beets must be organically grown.

Sugar beets far outstrip table beets in terms of U.S. production as well as production worldwide. Approximately 30 million tons of sugar beets are grown and harvested in the U.S. each year, with Minnesota, North Dakota, and Idaho producing the greatest volume. Worldwide, sugar beet production production averages close to 300 million tons, with the Russian Federation, France, United States, and Germany among the leading sugar beet producers. On a global basis, over 12,500,000 acres of sugar beets are plants each year. In the U.S. approximately 1,250,000 acres of sugar beets are planted each year, By comparison, only 700 acres are planted in the production of U.S. table beets.

How to Select and Store

Beet Greens are available throughout the garden season. Here are a few things to look for when selecting fresh beet greens:

When choosing beet greens that comes attached to the roots, choose smaller beet roots over larger, tougher ones. Beets over 2-1/2 inches in diameter may be tough and have a woody core. Pass over any beet roots that are cracked, soft, bruised, or shriveled, or look very dry. Avoid elongated beets with round, scaly areas around the top surface. These beets will be tough, fibrous, and strongly flavored.

If the beet greens are still attached to the root, they should be crisp looking and not wilted or slimy. They should appear fresh, tender, and have a lively green color.

Cut the majority of the greens and their stems from the beet roots. Store the unwashed greens in a separate plastic bag squeezing out as much of the air as possible. Place in refrigerator where they will keep fresh for about four days. Loss of some nutrients in beet greens—for example, its vitamin C content—is likely to be slowed down through refrigeration.

How to Enjoy

A Few Quick Serving Ideas

- Add layers of beet greens to your next lasagna recipe.
- Pine nuts are a great addition to cooked beet greens..

WHFoods Recipes That Feature Beet Greens

You can substitute the spinach in any of the spinach recipes with beet greens:

- Poached Eggs over Spinach
- Poached Eggs over Spinach & Mushrooms
- Mediterranean Baby Spinach Salad

- Warm Spinach Salad with Tuna
- Indian-Style Lentils
- 1-Minute Spinach
- Golden Spinach and Sweet Potato Healthy Sauté

Safety

Oxalate Content

Beet greens have consistently been determined to have high oxalate content. Oxalates are naturally occurring organic acids found in a wide variety of foods, and in the case of certain medical conditions, they must be greatly restricted in a meal plan to prevent over-accumulation inside the body. Our comprehensive article about oxalates will provide you with practical and detailed information about these organic acids, food, and health.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Beet Greens, boiled **1.00 cup** **144.00 grams**				**Calories: 39** **GI: not available**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin K	696.96 mcg	774	358.5	excellent
vitamin A	551.09 mcg RAE	61	28.3	excellent
vitamin C	35.86 mg	48	22.1	excellent
copper	0.36 mg	40	18.5	excellent
potassium	1308.96 mg	37	17.3	excellent
manganese	0.74 mg	37	17.1	excellent
vitamin B2	0.42 mg	32	15.0	excellent
magnesium	97.92 mg	24	11.3	excellent
vitamin E	2.61 mg (ATE)	17	8.1	excellent
fiber	4.18 g	17	7.7	excellent
calcium	164.16 mg	16	7.6	excellent
iron	2.74 mg	15	7.0	very good
vitamin B1	0.17 mg	14	6.6	very good
vitamin B6	0.19 mg	11	5.2	very good
pantothenic acid	0.47 mg	9	4.4	very good
phosphorus	59.04 mg	8	3.9	very good
protein	3.70 g	7	3.4	very good
zinc	0.72 mg	7	3.0	good
folate	20.16 mcg	5	2.3	good
vitamin B3	0.72 mg	5	2.1	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%

very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Beets

What's New and Beneficial About Beets

- Beets are a unique source of phytonutrients called betalains. Betanin and vulgaxanthin are the two best-studied betalains from beets, and both have been shown to provide antioxidant, anti-inflammatory, and detoxification support. The detox support provided by betalains includes support of some especially important Phase 2 detox steps involving glutathione. Although you can see these betalain pigments in other foods (like the stems of chard or rhubarb), the concentration of betalains in the peel and flesh of beets gives you an unexpectedly great opportunity for these health benefits.
- Unlike some other food pigments, betalains undergo very steady loss from food as the length of cooking time is increased. For example, one recent study has shown the red betalain pigments in beets to be far less heat stable than red anthocyanin pigments in red cabbage. The difference between 15 minutes of steaming versus 25 minutes of steaming, or 60 minutes of roasting versus 90 minutes of roasting can be significant in terms of betalain damage. For these reasons, we recommend that you keep beet steaming times to 15 minutes or less, and roasting times under an hour.
- An estimated 10-15% of all U.S. adults experience beeturia (a reddening of the urine) after consumption of beets in everyday amounts. While this phenomenon is not considered harmful in and of itself, it may be a possible indicator of the need for healthcare guidance in one particular set of circumstances involving problems with iron metabolism. Individuals with iron deficiency, iron excess, or specific problems with iron metabolism are much more likely to experience beeturia than individuals with healthy iron metabolism. For this reason, if you experience beeturia and have any reason to suspect iron-related problems, we recommend a healthcare consult to follow up on possible issues related to iron status.
- In recent lab studies on human tumor cells, betanin pigments from beets have been shown to lessen tumor cell growth through a number of mechanisms, including inhibition of pro-inflammatory enzymes (specifically, cyclooxygenase enzymes). The tumor cell types tested in these studies include tumor cells from colon, stomach, nerve, lung, breast, prostate and testicular tissue. While lab studies by themselves are not proof of beets' anti-cancer benefits, the results of these studies are encouraging researchers to look more closely than ever at the value of betanins and other betalains in beets for both prevention and treatment of certain cancer types.
- There has been some confusion about the nutritional value of beets in terms of their lutein/zeaxanthin content. (Lutein and zeaxanthin are two carotenoid phytonutrients that play an important role in health, and especially eye health.) Beet greens are usually a valuable source of lutein/zeaxanthin. One cup of raw beet greens may contain over 275 micrograms of lutein! Beet roots are not nearly so concentrated in lutein, although some beet roots - like the roots of yellow beets - may be valuable sources of this carotenoid. (Lutein can contribute to the yellow color of vegetables, and so yellow root vegetables—like yellow carrots or yellow beets—often contain more lutein than orange or red versions of these foods.)

WHFoods Recommendations

Foods belonging to the chenopod family — including beets, chard, spinach and quinoa — continue to show an increasing number of health benefits not readily available from other food families. The red and yellow betalain pigments found in this food family, their unique epoxyxanthophyll carotenoids, and the special connection between their overall phytonutrients and our nervous system health (including our specialized nervous system organs like the eye) point to the chenopod family of foods as unique in their health value. While we have yet to see large-scale human studies that point to a recommended minimum intake level for foods from this botanical family, we have seen data on chenopod phytonutrients, and based on this data, we recommend that you include foods from the chenopod family in your diet 1-2 times per week. In the case of a root food like beetroot, we recommend a serving size of at least one-half whole medium beet, and even more beneficial, at least 1 whole medium beet so that you can also benefit from their nutrient-rich greens.

If long cooking times deter you from cooking beets, our Healthiest Way of Cooking beets will help you prepare them in just 15 minutes. Cut medium beets into quarters without removing the skin. Steam and serve as a great vegetable side dish or as a wonderful addition to your favorite salad.

It is often difficult to believe how the hardy, crunchy, often rough-looking exterior of raw beets can be transformed into something wonderfully soft and buttery once they are cooked. See Healthiest Way of Cooking Beets in the How to Enjoy section below.

Beets, sliced, cooked **1.00 cup** **(170.00 grams)**	**Calories: 75** **GI: med**

Nutrient	DRI/DV
folate	34%
manganese	28%
potassium	15%
copper	14%
fiber	14%
magnesium	10%
phosphorus	9%
vitamin C	8%
iron	7%
vitamin B6	6%

Health Benefits

Remember all those legendary Russian centenarians? Beets, frequently consumed either pickled or in borscht, the traditional Russian soup, may be one reason behind their long and healthy lives. These colorful root vegetables contain powerful nutrient compounds that help protect against heart disease, birth defects and certain cancers, especially colon cancer.

Promote Optimal Health

The pigments that give beets their rich colors are called *betalains*. There are two basic types of betalains: betacyanins and betaxanthins. Betacyanins are pigments are red-violet in color. Betanin is the best studied of the betacyanins. Betaxanthins are yellowish in color. In light or dark red, crimson, or purple colored beets, betacyanins are the dominant pigments. In yellow beets, betaxanthins predominate, and particularly the betaxanthin called vulgaxanthin. All betalains come from the same original molecule (betalamic acid). The addition of amino acids or amino acid derivatives to betalamic acid is what determines the specific type of pigment that gets produced. The betalain pigments in beets are water-soluble, and as pigments they are somewhat unusual due to their nitrogen content. Many of the betalains function both as antioxidants and anti-inflammatory molecules. At the same time, they themselves are also very vulnerable to oxidation (change in structure due to interaction with oxygen). In addition to beets, rhubarb, chard, amaranth, prickly pear cactus, and Nopal cactus are examples of foods that contain betalains.

It's interesting to note that humans appear to vary greatly in their response to dietary betalains. In the United States, only 10-15% of adults are estimated to be "betalain responders." A betalain responder is a person who has the capacity to absorb and metabolize enough betalains from beet (and other foods) to gain full antioxidant, anti-inflammatory, and Phase 2 triggering benefits. (Phase 2 is the second step in our cellular detoxification process).

Antioxidant Benefits

What's most striking about beets is not the fact that they are rich in antioxidants; what's striking is the unusual mix of antioxidants that they contain. We're used to thinking about vegetables as rich in antioxidant carotenoids, and in particular, beta-carotene; among all well-studied carotenoids, none is more commonly occurring in vegetables than beta-carotene.

When it comes to antioxidant phytonutrients that give most red vegetables their distinct color, we've become accustomed to thinking about anthocyanins. (Red cabbage, for example, gets it wonderful red color primarily from anthocyanins.) Beets demonstrate their antioxidant uniqueness by getting their red color primarily from betalain antioxidant pigments (and not primarily from anthocyanins). Coupled with their status as a very good source of the antioxidant manganese and a good source of the antioxidant vitamin C, the unique phytonutrients in beets provide antioxidant support in a different way than other antioxidant-rich vegetables. While research is largely in the early stage with respect to beet antioxidants and their special benefits for eye health and overall nerve tissue health, we expect to see study results showing these special benefits and recognizing beets as a standout vegetable in this area of antioxidant support.

Anti-Inflammatory Benefits

Many of the unique phytonutrients present in beets have been shown to function as anti-inflammatory compounds. In particular, this anti-inflammatory activity has been demonstrated for betanin, isobetanin, and vulgaxanthin. One mechanism allowing these phytonutrients to lessen inflammation is their ability to inhibit the activity of cyclo-oxygenase enzymes (including both COX-1 and COX-2). The COX enzymes are widely used by cells to produce messaging molecules that trigger inflammation. Under most circumstances, when inflammation is needed, this production of pro-inflammatory messaging molecules is a good thing. However, under other circumstances, when the body is undergoing chronic, unwanted inflammation, production of these inflammatory messengers can make things worse. Several types of heart disease—including atherosclerosis—are characterized by chronic unwanted inflammation. For this reason, beets have been studied within the context of heart disease, and there are some encouraging although very preliminary results in this area involving animal studies and a few very small scale human studies. Type 2 diabetes—another health problem associated with chronic, unwanted inflammation—is also an area of interest in this regard, with research findings at a very preliminary stage.

In addition to their unusual betalain and carotenoid phytonutrients, however, beets are also an unusual source of betaine. Betaine is a key body nutrient made from the B-complex vitamin, choline. (Specifically, betaine is simply choline to which three methyl groups have been attached.) In and of itself, choline is a key vitamin for helping regulate inflammation in the cardiovascular system since adequate choline is important for preventing unwanted build-up of homocysteine. (Elevated levels of homocysteine are associated with unwanted inflammation and risk of cardiovascular problems like atherosclerosis.) But betaine may be even more important in regulation of our inflammatory status as its presence in our diet has been associated with lower levels of several inflammatory markers, including C reactive protein, interleukin-6, and tumor necrosis factor alpha. As a group, the anti-inflammatory molecules found in beets may eventually be shown to provide cardiovascular benefits in large-scale human studies, as well as anti-inflammatory benefits for other body systems.

Support of Detoxification

The betalin pigments present in beets have repeatedly been shown to support activity in our body's Phase 2 detoxification process. Phase 2 is the metabolic step that our cells use to hook activated, unwanted toxic substances up with small nutrient groups. This "hook up" process effectively neutralizes the toxins and makes them sufficiently water-soluble for excretion in the urine. One critical "hook up" process during Phase 2 involves an enzyme family called the glutathione-S-transferase family (GSTs). GSTs hook toxins up with glutathione for neutralization and excretion from the body. The betalains found in beet have been shown to trigger GST activity, and to aid in the elimination of toxins that require glutathione for excretion. If you are a person who thinks about exposure to toxins and wants to give your body as much detox support as possible, beets are a food that belongs in your diet.

Other Health Benefits

It's important to note two other areas of potential health benefits associated with beets: anti-cancer benefits and fiber-related benefits. The combination of antioxidant and anti-inflammatory molecules in beets makes this food a highly-likely candidate for risk reduction of many cancer types. Lab studies on human tumor cells have confirmed this possibility for colon, stomach, nerve, lung, breast, prostate and testicular cancers. Eventually, we expect to see large-scale human studies that show the risk-reducing effect of dietary beet intake for many of these cancer types.

Beet fiber has also been a nutrient of increasing interest in health research. While many people tend to lump all food fiber into one single category called "dietary fiber," there is evidence to suggest that all dietary fiber is not the same. Beet fiber (along with carrot fiber) are two specific types of food fiber that may provide special health benefits, particularly with respect to health of our digestive tract (including prevention of colon cancer) and our cardiovascular system. Some beet fiber benefits may be due to the pectin polysaccharides that significantly contribute to the total fiber content.

Description

Both beets and Swiss chard are different varieties within the same plant family (*Amaranthaceae-Chenopodiaceae*) and their edible leaves share a resemblance in both taste and texture. Attached to the beet's green leaves is a round or oblong root, the part conjured up in most people's minds by the word "beet." Although typically a beautiful reddish-purple hue, beets also come in varieties that feature white, golden/yellow or even rainbow color roots. No matter what their color, however, beet roots aren't as hardy as they look; the smallest bruise or puncture will cause red beets' red-purple pigments (which contain a variety of phytonutrients including betalains and anthocyanins) to bleed, especially during cooking. Betalain pigments in beets are highly-water soluble, and they are also temperature sensitive. For both of these reasons, it is important to treat beets as a delicate food, even though they might seem "rock solid" and difficult to damage.

Beets' sweet taste reflects their high sugar content, which makes beets an important source for the production of refined sugar (yet, the beets that are used for sugar consumption are of a different type than the beets that you purchase in the store). Raw beet roots have a crunchy texture that turns soft and buttery when they are cooked. Beet leaves have a lively, bitter taste similar to chard. The main ingredient in the traditional eastern European soup, borscht, beets are delicious eaten raw, but are more typically cooked or pickled.

The greens attached to the beet roots are delicious and can be prepared like spinach or Swiss chard. They are incredibly rich in nutrients, concentrated in vitamins and minerals as well as carotenoids such as beta-carotene and lutein/zeaxanthin.

While beets are available throughout the year, their season runs from June through October when the youngest, most tender beets are easiest to find.

History

The wild beet, the ancestor of the beet with which we are familiar today, is thought to have originated in prehistoric times in North Africa and grew wild along Asian and European seashores. In these earlier times, people exclusively ate the beet greens and not the roots. The ancient Romans were one of the first civilizations to cultivate beets to use their roots as food. The tribes that invaded Rome were responsible for spreading beets throughout northern Europe where they were first used for animal fodder and later for human consumption, becoming more popular in the 16th century.

Beets' value grew in the 19th century when it was discovered that they were a concentrated source of sugar, and the first sugar factory was built in Poland. When access to sugar cane was restricted by the British, Napoleon decreed that the beet be used as the primary source of sugar, catalyzing its popularity. Around this time, beets were also first brought to the United States, where they now flourish. Today the leading commercial producers of beets include the United States, the Russian Federation, France, Poland, France and Germany.

How to Select and Store

Choose small or medium-sized beets whose roots are firm, smooth-skinned and deep in color. Smaller, younger beets may be so tender that peeling won't be needed after they are cooked.

Avoid beets that have spots, bruises or soft, wet areas, all of which indicate spoilage. Shriveled or flabby should also be avoided as these are signs that the roots are aged, tough and fibrous.

While the quality of the greens does not reflect that of the roots, if you are going to consume this very nutritious part of the plant, look for greens that appear fresh, tender, and have a lively green color.

Cut the majority of the greens and their stems from the beet roots, so they do not pull away moisture away from the root. Leave about two inches of the stem attached to prevent the roots from "bleeding." Do not wash beets before storing. Place in a plastic bag and wrap the bag tightly around the beets, squeezing out as much of the air from the bag as possible, and place in refrigerator where they will keep for up to 3 weeks. Loss of some nutrients in beets—for example, its vitamin C content—is likely to be slowed down through refrigeration.

Store the unwashed greens in a separate plastic bag squeezing out as much of the air as possible. Place in refrigerator where they will keep fresh for about four days.

Raw beets do not freeze well since they tend to become soft upon thawing. Freezing cooked beets is fine; they'll retain their flavor and texture.

How to Enjoy

A Few Quick Serving Ideas

- Simply grate raw beets for a delicious and colorful addition to salads or decorative garnish for soups.
- Healthy Boil beet greens for 1 minute for a great tasting side dish, which is very similar to Swiss chard.
- Marinate steamed beets in fresh lemon juice, extra virgin olive oil, and fresh herbs.

WHFoods Recipes That Feature Beets

15-Minute Beets

Safety

Beeturia

Consumption of beets can cause urine to become red or pink in color. This condition"called beeturia"is not considered harmful. About 5-15% of U.S. adults are estimated to experience beeturia following consumption of beets in everyday amounts. One area in which beeturia may be a potential concern involves problems with iron metabolism. Persons with iron deficiency, iron excess, or known problems with the metabolism of iron are more likely to experience beeturia. If you experience beeturia and also suspect iron deficiency, iron excess, or iron metabolism to be a problem affecting your health, we recommend that you consult with your healthcare provider to determine your best dietary and health steps.

It's possible for beet consumption to bring a red color into your bowel movements as well, although this outcome tends to be more common in children than adults. Once again, the production of a reddish color in the stool due to beets is not considered harmful. It's important, however, to be confident that the reddening of the stool is caused by the pigments found in beets and not by the presence of fresh or dried blood. If you experience reddening of the stool and have not recently (with the past 24-48 hours) consumed beets, we recommend that you consult with your healthcare provider to determine the reason for this change in your stool color.

Oxalate Content

Beets have consistently been determined to have high oxalate content. Oxalates are naturally occurring organic acids found in a wide variety of foods, and in the case of certain medical conditions, they must be greatly restricted in a meal plan to prevent over-accumulation inside the body. Our comprehensive article about oxalates will provide you with practical and detailed information about these organic acids, food, and health.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Beets, sliced, cooked **1.00 cup** **170.00 grams**				**Calories: 75** **GI: med**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
folate	136.00 mcg	34	8.2	excellent
manganese	0.55 mg	28	6.6	very good
potassium	518.50 mg	15	3.6	very good
copper	0.13 mg	14	3.5	very good
fiber	3.40 g	14	3.3	good
magnesium	39.10 mg	10	2.4	good
phosphorus	64.60 mg	9	2.2	good
vitamin C	6.12 mg	8	2.0	good
iron	1.34 mg	7	1.8	good
vitamin B6	0.11 mg	6	1.6	good

World's Healthiest Foods Rating	**Rule**
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Bell peppers

About Bell Peppers

A wonderful combination of tangy taste and crunchy texture, sweet bell peppers are the Christmas ornaments of the vegetable world with their beautifully shaped glossy exterior that comes in a wide array of vivid colors ranging from green, red, yellow, orange, purple, brown to black. Despite their varied palette, all are the same plant, known scientifically as *Capsicum annuum*. They are members of the nightshade family, which also includes potatoes, tomatoes and eggplant. Sweet peppers are plump, bell-shaped vegetables featuring either three or four lobes. Green and purple peppers have a slightly bitter flavor, while the red, orange and yellows are sweeter and almost fruity. Paprika can be prepared from red bell peppers (as well as from chili peppers). Bell peppers are not 'hot'. The primary substance that controls "hotness" in peppers is called capsaicin, and it's found in very small amounts in bell peppers. Although peppers are available throughout the year, they are most abundant and tasty during the summer and early fall months.

What's New and Beneficial about Bell Peppers

- Bell pepper is not only an excellent source of carotenoids, but also a source of over 30 different members of the carotenoid nutrient family. A recent study from Spain took a close look vitamin C, vitamin E, and six of these carotenoids (alpha-carotene, beta-carotene, lycopene, lutein, cryptoxanthin and zeaxanthin) in all commonly eaten foods and found that only two vegetables contained at least two-thirds of all the listed nutrients. One of these foods was tomato, and the other was sweet bell pepper! Bell pepper alone provided 12% of the total zeaxanthin found in the participants' diets. (Bell pepper also provided 7% of the participants' total vitamin C intake.)
- If you want to maximize the availability of vitamin C and carotenoids from bell pepper, allow this amazing vegetable to ripen. Recent studies have shown that the vitamin C content and the carotenoid content of bell pepper both increase with ripening. When the vitamin C and carotenoid content of bell peppers increases, so does their total antioxidant capacity, which can be a source of great health benefits. Growers can allow bell peppers to ripen on the plant prior to harvest (which means that you will be able to purchase them in the grocery store in a ripened state). Or, if harvested early in the ripening stage, bell peppers can still be allowed to ripen post-harvest and after you've purchased them and brought them home from the market. In one recent study, the vitamin C in not-fully-ripe bell peppers continued to increase during home storage over a period of about 10 days. It can, though, be difficult to tell whether a bell pepper is optimally ripe. Most--but not all--green bell peppers will turn red in color over time, but they may be optimally ripe before shifting over from green to red. A good rule of thumb is to judge less by their basic color and more by their color quality as well as overall texture and feel. Whether green, red, yellow, or orange, optimally ripe bell peppers will have deep, vivid colors, feel heavy for their size, and be firm enough to yield only slightly to pressure.
- Higher heat cooking can damage some of the delicate phytonutrients in bell peppers. In one recent study from Turkey, the effects of grilling on sweet green bell peppers were studied with respect to one particular phytonutrient--the flavonoid called luteolin. Prior to grilling, the bell peppers were found to contain about 46 milligrams/kilogram of this important antioxidant and anti-inflammatory flavonoid. After grilling for 7-8 minutes at a temperature of 150°C (302°F), about 40% of the luteolin was found to be destroyed. This loss of luteolin from higher heat cooking is one of the reasons we like cooking methods for bell peppers that use lower heat for a very short period of time.
- Although we tend to think about cruciferous vegetables like broccoli or allium vegetables like onions and garlic as vegetables that are richest in sulfur-containing compounds, bell peppers can also be valuable sources of health-supportive sulfur compounds. Several recent studies have taken a close look at the presence of enzymes in bell peppers called *cysteine S-conjugate beta-lyases* and their role in a sulfur-containing metabolic pathway called the thiomethyl shunt. These enzymes and this pathway may be involved in some of the anti-cancer benefits that bell pepper has shown in some animal and lab studies. They may serve as the basis for some of the anti-cancer benefits shown by green, yellow, red and orange vegetable intake in recent studies, including a recent study on risk reduction for gastric cancer and esophageal cancer.

Bell Peppers, sliced, red, raw
1.00 cup
(92.00 grams)

Calories: 29
GI: very low

Nutrient	DRI/DV
vitamin C	157%
vitamin B6	16%
vitamin A	16%
folate	11%

molybdenum	10%
vitamin E	10%
fiber	7%
pantothenic acid	6%
potassium	6%
vitamin B3	6%
vitamin B2	6%
vitamin K	5%
manganese	5%
vitamin B1	4%
phosphorus	3%
magnesium	3%

Health Benefits

While bell peppers are a very popular vegetable, they have not always shared the health research spotlight with other members of the pepper family due to their very minimal content of the phytonutrient capsaicin, the well-researched pepper compound that gives hot peppers their "heat." Once active in the body, capsaicin can bind onto nerve cell receptors and change pain sensation, and it may also have important anti-cancer and blood-sugar balancing properties. However, the lack of "heat" or significant amounts of capsaicin in bell peppers does not mean that this vegetable should be denied the health research spotlight!

The actual nutrient and phytonutrient content of bell peppers is impressive - and also somewhat surprising given the very low-fat nature of this vegetable (some nutrients and phtyonutrients are fat-soluble and hence for them to be present the food needs to contain some fat). There is far less than 1 gram of total fat in one cup of sliced bell pepper. However, this very small amount of fat is enough to provide a reliable storage spot for bell pepper's fat-soluble nutrients, including its fat-soluble carotenoids and vitamin E. Bell pepper is a very good source of vitamin E at about 1.45 milligrams per cup, and it contains more than 30 different carotenoids, including excellent amounts of beta-carotene and zeaxanthin. Both of these carotenoids provide antioxidant and anti-inflammatory health benefits. Within this Health Benefits section, we'll focus on two areas of bell pepper research: research on the antioxidant benefits, and research on potential anti-cancer benefits.

Antioxidant Benefits

While research studies have tended to focus on carotenoids as the hallmark antioxidants in bell pepper, this vegetable actually provides us with a very broad range of antioxidants. In terms of conventional nutrients, bell pepper is an excellent source of vitamin C at 117 milligrams per cup. (That's more than twice the amount of vitamin C found in a typical orange.) Bell pepper is also a good source of another antioxidant vitamin--vitamin E. In addition to these conventional antioxidant vitamins, bell pepper is also a good source of the antioxidant mineral manganese. The list of bell pepper phytonutrients is also impressive and includes:

- Flavonoids
    - luteolin
    - quercetin
    - hesperidin
- Carotenoids
    - alpha-carotene
    - beta-carotene
    - cryptoxanthin
    - lutein
    - zeaxanthin
- Hydroxycinnamic Acids
    - ferulic acid
    - cinnamic acid

Within this list of phytonutrient antioxidants, it's understandable why carotenoids have been singled out for research attention. Among the five carotenoids listed above, bell pepper contains concentrated amounts of beta-carotene and zeaxanthin. (One cup of freshly sliced red bell pepper, for example, contains about 1,500 micrograms of beta-carotene, or the same as one third of a small carrot.) In a recent study from Spain, researchers took a close look at vitamin C, vitamin E, and six different carotenoids (alpha-carotene, beta-carotene, lycopene, lutein, cryptoxanthin and zeaxanthin) found in all commonly eaten foods. Only two vegetables were determined to contain at least two-thirds of these nutrients. One of these foods was tomato, and the other was sweet bell pepper! In addition, bell pepper alone was determined to provide 12% of the total zeaxanthin found in the participants' diets! Bell pepper alone was also found to provide 7% of the participants' total vitamin C intake.

This remarkable track record for bell peppers as an antioxidant-rich food has yet to be translated into research on risk reduction for disease. We expect to see antioxidant benefits specifically from bell peppers showing up in a wide variety of human health studies, including studies on prevention of cardiovascular disease and prevention of type 2 diabetes. We also expect to see antioxidant benefits showing up strongly in the area of eye health. Just one cup of sweet green bell pepper slices provides us with 314 micrograms (combined) of the carotenoids lutein and zeaxanthin. These two particular carotenoids are found in high concentrations in the macula of the eye (the centermost part of the retina), and they are required for protection of the macula from oxygen-related damage. In one condition called age-related macular degeneration, or AMD, the macula of the eye can become damaged and vision can become lost. (In the U.S., AMD is the leading case of blindness in adults over the age of 60.) We suspect that future human studies will show risk reduction for AMD with routine intake of bell peppers due to their strong antioxidant benefits (and in particular, their unique concentration of lutein and zeaxanthin).

Potential Anti-Cancer Benefits

As a food that is rich in antioxidant and anti-inflammatory nutrients, bell pepper would be expected to provide us with important anti-cancer benefits. Exposure to chronic excessive inflammation and chronic unwanted oxidative stress can increase the risk of cancer development for most cancer types, and both of these factors can be partly offset by diet. (Regular intake of antioxidant nutrients can lower the likelihood of chronic oxidative stress, and regular intake of anti-inflammatory nutrients can lower the likelihood of chronic excessive inflammation.) With a rich supply of phytonutrients that have antioxidant and anti-inflammatory properties, bell peppers would be expected to help offset these factors and lower our risk of cancer development. Unfortunately, large-scale human research studies have not tried to isolate the impact of bell peppers on cancer risk. At best, they have usually grouped bell peppers among other vegetables and analyzed the anti-cancer benefits of vegetables as a group. Still, we very much expect to see future studies documenting the specific benefits of bell peppers for risk reduction of cancer. Based on preliminary studies on animals and in the lab, cancers of the digestive tract (including gastric cancer and esophageal cancer) may be areas in which bell peppers end up showing a special potential for support.

Alongside of this antioxidant/anti-inflammatory component of bell peppers' potential anti-cancer benefits is a second, less expected component. This second component involves the metabolism of sulfur compounds in bell pepper, and in particular the metabolism of the sulfur-containing amino acid cysteine. While bell pepper is not high in either protein or in the amino acid cysteine, it may be unusual in its metabolism of this amino acid. Several recent studies have taken a close look at the presence of enzymes in bell peppers called *cysteine S-conjugate beta-lyases* and their role in a sulfur-containing metabolic pathway called the thiomethyl shunt. These enzymes and this pathway may be involved in some of the anti-cancer benefits that bell pepper has shown in some preliminary animal and lab studies. They may serve as the basis for some of the anti-cancer benefits shown by green, yellow, red and orange vegetable intake in recent studies, including a recent study on risk reduction for gastric cancer and esophageal cancer.

Description

Bell peppers belong to the nightshade (Solanaceae) family of plants, along with chili pepper, cayenne pepper, eggplant, tomatoes and potatoes (except sweet potatoes and yams). Their scientific name is *Capsicum annuum*. This scientific name, however, is used to refer not only to bell peppers, but also to wax peppers, cayenne peppers, chili peppers, and jalapeno peppers.

While we are most accustomed to seeing green bell peppers in the supermarket, these delicious vegetables actually come in a wide variety of colors, including yellow, orange, red, purple, brown and black. The green bell peppers you purchase in the food market may actually be immature, non-ripe versions of these other color varieties. Not all bell peppers start off green, however, nor do green bell peppers always mature into other basic colors.

Paprika is a dried powdered form of bell pepper, and even though we are used to seeing red paprika in the spice section of the grocery, a paprika can be made from any color of bell pepper and it will end up being that same color once dried and ground into powder.

Bell peppers can be eaten at any stage of development. However, recent research has shown that the vitamin C and carotenoid content of bell peppers tends to increase while the pepper is reaching its optimal ripeness. Bell peppers are also typically more flavorful when optimally ripe.

History

Bell peppers have been cultivated for more than 9000 years, with the earliest cultivation having taken place in South and Central America. While the name "pepper" was given to this food by European colonizers of North America who first came across it in the 1500-1600's and then transported it back to Europe, the original name for this food in Spanish was *pimiento*.

Because bell peppers can be grown in a variety of climates and are popular in cuisines throughout the world, they can frequently be found on small farms in North America, Central America, South America, Europe, Africa, the Middle East, and parts of Asia. In terms of commercial production, however, China has become by far the largest producer of bell peppers and produced 14 million metric tons in 2007. At about 2 million metric tons, Mexico is the second largest commercial producer, followed by the United States at approximately 1 million metric tons.

Within the U.S., California and Florida are the largest bell pepper-producing states. (In terms of chili pepper production, however, New Mexico currently stands in first place.) . The average U.S. adult consumes about 16 pounds of peppers per year, including almost 9.5 pounds of bell peppers.

How to Select and Store

Choose peppers that have deep vivid colors, taut skin, and that are free of soft spots, blemishes and darkened areas. Their stems should be green and fresh looking. Peppers should be heavy for their size (reflecting their thick, well-formed and well-hydrated walls) and firm enough so that they will only yield slightly to a small amount of pressure. Avoid those that have signs of decay including injuries to the skin or water-soaked areas. The shape of the pepper does not generally affect the quality, although it may result in excessive waste or not be suitable to certain recipe preparations. Peppers are available throughout the year but are usually in greater abundance during the summer and early fall months.

It can be difficult to tell whether a bell pepper is optimally ripe, but from a nutritional and health standpoint, it is definitely worth paying attention to the degree of ripeness in your bell peppers. You don't want them to be overly ripe to the point of getting too soft, wrinkly, or blemished. In fact, if bell peppers are optimally ripe at the time of purchase, they can lose up to 15% of their vitamin C content over the course of 10-day storage in the refrigerator and up to 25% of their vitamin C over 20-days of refrigerator storage time. However, if not optimally ripe at the time of purchase, the vitamin C and carotenoids in bell peppers will actually *increase* with refrigerator storage over the next 10 days. So as you can see, there is a delicate balance in terms of optimal ripeness! We encourage you not to worry about eating bell peppers that are not yet optimally ripe, because they can still provide you with outstanding health benefits. But for optimal vitamin C and carotenoid benefits, you may want to experiment a little and see if you can develop a skill for evaluating ripeness in this vegetable. Unfortunately, you cannot use basic color as your primary guideline. Most - but not all - green bell peppers will turn red in color over time, but they may be optimally ripe before shifting over from green to red. (There are also some varieties of bell peppers which never start out green.) A good rule of thumb is to judge not by the color itself but by the color quality and overall texture and feel. Whether green, red, yellow, or orange, optimally ripe bell peppers will have deep, vivid colors, will feel heavy for their size, and will be firm enough to yield only slightly to pressure.

Unwashed sweet peppers stored in the vegetable compartment of the refrigerator will keep for approximately 7-10 days. Loss of some nutrients in bell peppers—for example, its vitamin C content—is likely to be slowed down through refrigeration.Because bell peppers need to still well hydrated and are very sensitive to moisture loss, we further recommend that you include a damp cloth or paper towel in the vegetable compartment to help the peppers retain their moisture. Do not cut out the bell pepper stem prior to storage in the refrigerator. Bell peppers are especially sensitive to moisture loss through this stem (calyx) portion and are more susceptible to chilling injury if the stem is removed. Sweet peppers can be frozen without first being blanched. It is better to freeze them whole since there will be less exposure to air which can degrade both their nutrient content and flavor.

Although most people would not consider washing bell peppers under hot water, we want to be clear about the disadvantages of doing so. A recent study has shown that bell peppers retain more of their total antioxidant capacity when washed under cold versus hot water.

Finally, if you are going to consume your bell peppers within a day or two and suspect that they are not fully ripe, you may want to consider storing them without refrigeration. We've seen one recent study showing that room temperature storage of 20°C (68°F) can improve the availability of fat-soluble carotenoids in bell peppers that are not yet optimally ripe.

How to Enjoy

A Few Quick Serving Ideas

- Add finely chopped bell peppers to tuna or chicken salad.
- After Healthy Sautéeing chopped peppers, celery and onions, combine with tofu, chicken or seafood to make a simple Louisiana Creole dish.
- Purée roasted and peeled peppers with Healthy Sautéed onions and zucchini to make a deliciously refreshing soup that can be served hot or cold.
- Bell peppers are one of the best vegetables to serve in a crudité platter since not only do they add a brilliant splash of color, but their texture is also the perfect crunchy complement for dips.

WHFoods Recipes That Include Bell Peppers

- Italian Tofu Frittata
- 15-Minute Black Bean Salad
- Healthy Caesar Salad
- Healthy Veggie Salad
- Cajun Kidney Bean Chili
- Seafood Gazpacho
- Spicy Posole Soup
- Zesty Mexican Soup
- 15-Minute Maui-Style Cod
- Mediterranean Cod
- Salmon with Dill Sauce
- Southwestern Salmon & Black Beans
- 15-Minute Healthy Sautéed Asparagus and Tofu
- Black Bean Burrito, Indian Style
- Black Bean Chili
- Braised Kidney Beans & Sweet Potato
- Mediterranean Lentil Salad
- Moroccan Eggplant with Garbanzo Beans
- Primavera Verde
- Spicy Black Bean Burrito
- 5-Minute Cold Cucumber Salad
- Romaine & Avocado Salad
- Garlic Dip with Crudites
- Sautéed Vegetables with Cashews
- Tahini and Crudités Appetizer

Safety

Bell Pepper Belongs to the Nightshade Family

Bell Pepper is one of the vegetables that belong to the nightshade (Solanaceae) family. For helpful information about nightshade vegetables—including our WHFoods Recommendations—please see our article, Which foods are classified as "nightshades," and is it true that foods from this group can potentially contain problematic substances?

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Bell Peppers, sliced, red, raw **1.00 cup** **92.00 grams**	**Calories: 29** **GI: very low**

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin C	117.48 mg	157	98.9	excellent
vitamin A	144.03 mcg RAE	16	10.1	excellent
vitamin B6	0.27 mg	16	10.0	excellent
folate	42.32 mcg	11	6.7	very good
molybdenum	4.60 mcg	10	6.5	very good
vitamin E	1.45 mg (ATE)	10	6.1	very good
fiber	1.85 g	7	4.7	very good
vitamin B2	0.08 mg	6	3.9	very good
pantothenic acid	0.29 mg	6	3.7	very good
vitamin B3	0.90 mg	6	3.6	very good
potassium	194.12 mg	6	3.5	very good
vitamin K	4.51 mcg	5	3.2	good
manganese	0.10 mg	5	3.2	good
vitamin B1	0.05 mg	4	2.6	good
phosphorus	23.92 mg	3	2.2	good
magnesium	11.04 mg	3	1.7	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Bok choy

What's New and Beneficial About Bok Choy

- Because our preferred cooking method for bok choy has always been a Healthy Sauté, we are encouraged to see a recent study showing significantly improved availability of the carotenoid lutein from bok choy after stir-frying. Researchers in this study specifically compared 3 minutes of steaming to 6 minutes of stir-frying (with constant stirring during the stir-fry method) and found much improved availability of lutein after stir-frying versus steaming.
- Baby bok choy has become more widely available to U.S. consumers, and this wider availability is a good thing in terms of nutrition. A recent study has shown some unique characteristics of Baby Shanghai bok choy in terms of its phytonutrient contents. Specifically, among 17 different cruciferous vegetables analyzed in the study, Baby Shanghai bok choy was the only vegetable to contain high amounts of what the researchers called "Principle 1" and "Principle 2" phenols. "Principle 1" components were primarily flavonoids (and especially flavonoids related to kaempferol and quercetin). "Principle 2" components were non-flavonoid phenols, including molecules like malic acid and hydroxycinnamic acid).
- Phenols and other phytonutrients in bok choy represent what is now known to be a full spectrum of over 70 antioxidants in this cruciferous vegetable. The antioxidant richness of bok choy partly explains ongoing investigation of bok choy in relationship to cancer prevention, since prevention and reduction of oxidative stress has often been linked to decreased cancer risk. In most research studies, increased intake of antioxidant nutrients from vegetables like bok choy has been associated with decreased oxidative stress, and this connection is one way that researchers explain the ability of certain vegetables to lower cancer risk. (Too much oxidative stress can leave our cells too susceptible to damage from free radicals and too much at risk for potential transformation into pre-cancerous cells.)
- Just like its impressive range of antioxidant phytonutrients, glucosinolates are sulfur-containing compounds in bok choy associated with reduced cancer risk. While all cruciferous vegetable contain beneficial amounts of glucosinolates, a recent study on the total glucosinolate content of bok choy shoots has caught our attention. This study looked at very early developmental forms of cruciferous vegetables including their seeds (pre-planting); their sprouts (an early germination form representing about 1 week of growth); and their shoots (still an early growth stage, but involving more development of plant structure including a well-defined stem and some leaves and representing about 1-2 weeks of growth). What the researchers found was a greater concentration of total glucosinolates in the shoots of the bok choy plants than in the shoots of most other cruciferous vegetables, including broccoli, cabbage, cauliflower, and kale. Only mustard green shoots contained more total glucosinolates than the bok choy shoots.
- Because of its strong beta-carotene content, bok choy ranks as our 11th richest food in vitamin A. This vitamin A richness places bok choy ahead of some of its fellow cruciferous vegetables, including cauliflower, cabbage, Brussels sprouts, and broccoli. Significant amounts of other carotenoids—for example, lutein—are also provided by bok choy.

WHFoods Recommendations

You'll want to include bok choy as one of the cruciferous vegetables you eat on a regular basis if you want to receive the fantastic health benefits provided by the cruciferous vegetable family. We recommend a cruciferous vegetable serving of at least 3/4 cups per day. Even more outstanding would be an intake level of 1-1/2 cups per day. We've found bok choy to be a delightful alternative among the cruciferous vegetables for its quick preparation, enjoyable and easy-to-chew texture, milder and somewhat sweet taste, and versatility in recipes.

Enjoy the mild flavor of bok choy by using our Healthy Sauté method of cooking. Our 4-Minute Healthy Sautéed Bok Choy recipe will give you great tasting bok choy in a matter of minutes!

Bok Choy, cooked
1.00 cup
(170.00 grams)

Calories: 20
GI: very low

Nutrient	DRI/DV
vitamin K	64%
vitamin C	59%
vitamin A	40%
potassium	18%
folate	17%
calcium	16%
vitamin B6	16%

manganese	12%
iron	10%
vitamin B2	8%
fiber	7%
phosphorus	7%
protein	5%
magnesium	5%
choline	5%
vitamin B3	5%
vitamin B1	4%
zinc	3%
omega-3 fats	3%
copper	3%
pantothenic acid	3%

Health Benefits

Antioxidant Benefits

As an excellent source of vitamin C, vitamin A (in the form of carotenoids), and manganese, and a good source of zinc, bok choy provides us with a concentration of these core conventional antioxidants. Yet, its antioxidant support extends beyond these conventional antioxidants to a wide range of other phytonutrient antioxidants. These phytonutrients include flavonoids like quercetin, kaempferol, and isorhamnetin, as well as numerous phenolic acids (including significant amounts of hydroxycinnamic acids). It's important to understand the unique benefits provided by this diverse array of antioxidants. Different types of antioxidants function in different ways. While all types are helpful in preventing unwanted oxygen damage to our cells and body systems, different types of antioxidants go about this task in different ways, and it is the combination of these types in cruciferous vegetables—including bok choy—that make them so valuable in terms of their antioxidant support. (It is also a key reason why whole, natural foods like fresh bok choy provide you with benefits that antioxidant supplements cannot.) At least one study on bok choy has shown higher total phenol content in organically grown versus non organically grown bok choy. This study seems in keeping with research showing overall greater nutrient contents in organic versus non-organic food. Still, we would like to see some follow-up studies in this area, since there are many reasons why phenol content in bok choy might vary widely.

One interesting option for consumers of bok choy who are particularly interested in its antioxidant benefits is the commercial availability of purple bok choy. Sometimes called "Purple Choy" or "Pak Choi Rubi," purple cultivars of this cruciferous vegetable have been shown to contain anthocyanidins—the red-purple pigments that belong to the flavonoid category of antioxidants.

Anti-Inflammatory Benefits

Many of the antioxidant nutrients listed above also provide anti-inflammatory benefits. They not only lower the risk of oxygen-based damage to your cells and body systems, but they also lower your risk of unwanted chronic inflammation. While it is a good thing for your body's inflammatory system to respond promptly to dangers or actual damage, it is not a good thing for it to continuously trigger inflammatory responses when there is not danger or actual damage. Anti-inflammatory phytonutrients in bok choy help prevent this type of continuous and unwanted inflammation from occurring. Yet in addition to these phytonutrients, bok choy also provides you with two additional anti-inflammatory nutrients. The first of these nutrients are omega-3s. Bok choy ranks as a good source of omega-3s in our rating system due to its significant amount of alpha-linolenic acid (ALA). About 70 milligrams of ALA are found in one cup of cooked bok choy. While this amount does not put bok choy anywhere close to the top of our omega-3 plant vegetable list, it does qualify bok choy as being about one-half as concentrated in omega-3s as walnuts on a calorie-for-calorie basis. We have yet to see research on bok choy's omega-3 content and inflammation, but we would expect this kind of research to show bok choy omega-3s as being helpful in lowering risk of unwanted inflammation.

Another anti-inflammatory nutrient provided by bok choy is vitamin K. Bok choy ranks in our Top 15 vitamin K-rich foods and is an excellent source of this fat-soluble vitamin. While best know for its role in bone health and blood clotting, vitamin K has also been shown to help regulate our body's inflammatory responses, especially in relationship to our cardiovascular system.

Other Health Benefits

Bok choy has been included in human studies of cruciferous vegetables that have shown decreasing risk of certain cancers when these vegetables were consumed on a frequent basis, usually involving one or more daily servings. At least part of this protection has been associated with the glucosinolate content of the cruciferous vegetables, including bok choy. (Glucosinolates are unique sulfur-containing compounds that have been shown to have cancer-protective properties.) However, we have yet to see a study exclusively focused on bok choy in comparison to its fellow cruciferous vegetables, and we suspect that it would rank on the lower end in terms of its glucosinolate-related benefits since it contains a significantly lower amount of these sulfur-containing compounds than other vegetables in the cruciferous family like Brussels sprouts or mustard greens.

Description

Bok choy is a cruciferous vegetable that can go by many different names. Some of these different names for bok choy include white cabbage, mustard cabbage, celery cabbage, Chinese white cabbage, Chinese mustard, and white celery mustard. The English spelling of bok choy can also take several different forms. You might see the first word in this food name being spelled as "buk," "pok," or "pak." You might see the second word being spelled as "choi." And sometimes you might find these two words being combined into a single word like "pakchoi." Helping to make sense of many of the names above is the literal translation of "bok choy" in Chinese. The words "bok choy" come from "bai cai" where "bai" means "white" and "cai" means "cabbage."

Many of the cruciferous vegetables commonly eaten in the U.S. are known for the "heads" that they form in their more mature plant stages. Cauliflower, broccoli, cabbage, and Brussels sprouts can all fall into this category of "head-forming" cruciferous vegetables. By contrast, bok choy is a non-head-forming cruciferous vegetable, and in fact is sometimes referred to as "non-heading Chinese cabbage." While the leaves of the bok choy plant can cluster together in a noticeable way, they do not form a head and at times can be only loosely clustered together.

In many U.S. grocery stores, you are most likely to find bok choy that features green spoon-shaped leaves and slightly flattened white stalks. Varieties of bok choy that fall into this category include Mibuna Early, Canton, and Ching Chang. However, there are numerous varieties of bok choy and they can vary in their stalk color. While white and beige stalks are widely enjoyed, so are green stalks with many varying shades, including Shanghai Green and Green Boy. Also becoming more available in U.S. groceries are varieties of bok choy with purple leaves. Purple varieties of bok choy include Rubi and Purple Hybrid.

Just as you can find more than one recognizable form of bok choy, you can also find more than one scientific name for this cruciferous vegetable. The most common name is *Brassica rapa* L. subsp. *chinensis*. But you may also find bok choy being scientifically referred to as *Brassica chinensis* (where "chinensis" is used as a species name rather than a subspecies name). Also, you may occasionally see bok choy being identified as *Brassica campestris* L. subsp. *chinensis*.

History

Bok choy—and other forms of Chinese cabbage—has been enjoyed in China and other parts of Asia for over 1,500 years. And bok choy is by no means a total newcomer to North America either, having been cultivated on this continent for over 100 years. About 95 million pounds of Asian vegetables (the produce trading category which includes bok choy) are brought into the U.S. each year, primarily from Mexico). However, another 35 million pounds are produced in the U.S. The state of California dominates this domestic production, with smaller amounts being produced in Arizona and Texas. Some marketplace statistics on bok choy combine production of this vegetable together with overall cabbage production. If this approach is used, the numbers go up dramatically, since more than 2 billion pounds of cabbage are produced in the U.S. each year.

How to Select and Store

Look for bok choy with firm, bright green colored leaves (or purple, if you are purchasing a purple variety) and moist hardy stems. Bok choy should be displayed in a cool environment since warm temperatures will cause it to wilt and will negatively affect its flavor. The leaves should look fresh, be unwilted, and be free from signs of browning, yellowing, and small holes. Bok choy is available throughout the year, although it is more widely available, and at its peak, from the middle of winter through the beginning of spring.

To store, place bok choy in a plastic storage bag removing as much of the air from the bag as possible. Keeping bok choy cold will keep it fresh. In addition, loss of some nutrients in bok choy—for example, its vitamin C content—is likely to be slowed down through refrigeration. Put the whole head in a plastic bag in the crisper of your refrigerator. Bok choy will keep for about 1 week if properly stored.

How to Enjoy

A Few Quick Serving Ideas

- Healthy Sautébok choy with snow peas and mushrooms.
- Add a few drops of tamari soy sauce to bok choy recipe.
- Combine Healthy Sautéed bok choy with tofu or chicken for a complete meal.

WHFoods Recipes That Feature Bok Choy

- 15-Minute Steamed Halibut with Bok Choy
- 15-Minute Healthy Sautéed Chicken & Bok Choy
- 4-Minute Healthy Sautéed Bok Choy

Safety

Bok Choy and Goitrogens

You may sometimes hear bok choy being described as a food that contains "goitrogens," or as a food that is "goitrogenic." For helpful information in this area—including our WHFoods Recommendations—please see our article What is meant by the term "goitrogen" and what is the connection between goitrogens, food, and health?.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Bok Choy, cooked
1.00 cup
170.00 grams

Calories: 20
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin K	57.80 mcg	64	56.7	excellent
vitamin C	44.20 mg	59	52.0	excellent
vitamin A	361.16 mcg RAE	40	35.4	excellent
potassium	630.70 mg	18	15.9	excellent
folate	69.70 mcg	17	15.4	excellent
vitamin B6	0.28 mg	16	14.5	excellent
calcium	158.10 mg	16	14.0	excellent
manganese	0.24 mg	12	10.6	excellent
iron	1.77 mg	10	8.7	very good
vitamin B2	0.11 mg	8	7.5	very good
phosphorus	49.30 mg	7	6.2	very good
fiber	1.65 g	7	5.8	very good
protein	2.65 g	5	4.7	very good
choline	20.57 mg	5	4.3	good
magnesium	18.70 mg	5	4.1	good
vitamin B3	0.73 mg	5	4.0	good

vitamin B1	0.05 mg	4	3.7	good
copper	0.03 mg	3	2.9	good
omega-3 fats	0.07 g	3	2.6	good
zinc	0.29 mg	3	2.3	good
pantothenic acid	0.13 mg	3	2.3	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Broccoli

Broccoli is Our Food of the Week

This week we celebrate broccoli as our Food of the Week. Broccoli's unique flavor and incredible nutritional value have made it one of the most popular vegetables in the United States. Its unique health-promoting sulfur-containing compounds and concentration of vitamins and minerals make it a great choice to feature in your Healthiest Way of Eating.

For more on the Food of the Week

- Cutting Broccoli Florets
- Why is the food of the week among the WHFoods?">
- Healthy Eating with the Seasons

What's New and Beneficial About Broccoli

- Broccoli can provide you with some special cholesterol-lowering benefits if you will cook it by steaming. The fiber-related components in broccoli do a better job of binding together with bile acids in your digestive tract when they've been steamed. When this binding process takes place, it's easier for bile acids to be excreted, and the result is a lowering of your cholesterol levels. Raw broccoli still has cholesterol-lowering ability—just not as much.
- Broccoli has a strong, positive impact on our body's detoxification system, and researchers have recently identified one of the key reasons for this detox benefit. Glucoraphanin, gluconasturtiian, and glucobrassicin are 3 glucosinolate phytonutrients found in a special combination in broccoli. This dynamic trio is able to support all steps in body's detox process, including activation, neutralization, and elimination of unwanted contaminants. Isothiocyanates (ITCs) are the detox-regulating molecules made from broccoli's glucosinolates, and they help control the detox process at a genetic level.
- Broccoli may help us solve our vitamin D deficiency epidemic. When large supplemental doses of vitamin D are needed to offset deficiency, ample supplies of vitamin K and vitamin A help keep our vitamin D metabolism in balance. Broccoli has an unusually strong combination of both vitamin A (in the form of beta-carotene) and vitamin K. For people faced with the need to rebuild vitamin D stores through vitamin D supplements, broccoli may be an ideal food to include in the diet.
- Broccoli is a particularly rich source of a flavonoid called kaempferol. Recent research has shown the ability of kaempferol to lessen the impact of allergy-related substances on our body. This kaempferol connection helps to explain the unique anti-inflammatory benefits of broccoli, and it should also open the door to future research on the benefits of broccoli for a hypoallergenic diet.

WHFoods Recommendations

Studies have shown that even kids like broccoli and one way to ensure that they enjoy it is to cook it properly by using our Healthy Steaming method. Overcooked broccoli becomes soft and mushy, an indication that it has lost both nutrients and flavor. Begin by cutting broccoli florets into quarters and let sit for several minutes before cooking to enhance its health-promoting benefits. Steam for 5 minutes. See Healthiest Way of Cooking Broccoli below.

You'll want to include broccoli as one of the cruciferous vegetables you eat on a regular basis if you want to receive the fantastic health benefits provided by the cruciferous vegetable family. At a minimum, we recommend 3/4 cup of cruciferous vegetables on a daily basis. This amount is equivalent to approximately 5 cups per week. A more optimal intake amount would be 1-1/2 cups per day, or about 10 cups per week. You can use our Veggie Advisor for help in figuring out your best cruciferous vegetable options.

Broccoli, chopped, cooked
1.00 cup
(156.00 grams)

Calories: 55
GI: very low

Nutrient	DRI/DV
vitamin K	245%
vitamin C	135%
chromium	53%

folate	42%
fiber	21%
pantothenic acid	19%
vitamin B6	18%
vitamin E	15%
phosphorus	15%
manganese	15%
choline	15%
vitamin B2	15%
vitamin A	13%
potassium	13%
copper	11%
vitamin B1	8%
omega-3 fats	8%
magnesium	8%
protein	7%
zinc	6%
iron	6%
calcium	6%
selenium	5%
vitamin B3	5%

Health Benefits

It's no coincidence that more than 300 research studies on broccoli have converged in one unique area of health science—the development of cancer—and its relationship to three metabolic problems in the body. Those three problems are (1) chronic inflammation (2) oxidative stress, and (3) inadequate detoxification. While these types of problems have yet to become part of the public health spotlight, they are essential to understanding broccoli's unique health benefits. Over the past 5 years, research has made it clear that our risk of cancer in several different organ systems is related to the combination of these three problems.

The Cancer/Inflammation/Oxidative Stress/Detox Connection

Exposure to potentially toxic substances in our food and water, or in the air we breathe both indoors and outdoors, exposure to allergy-triggering substances, poor general health, dietary deficiencies, use of prescription and over-the-counter medications, and other lifestyle practices can result in a level of danger to our bodies that prompts our inflammatory system to work in overdrive on a 24/7 basis. Researchers often refer to this phenomenon as "chronic inflammation." Often contributing to this level of danger is a weakened detox ability in our body. If our liver, skin, and other organ systems cannot keep up with and detoxify the number of potential toxins that we encounter, too many potential toxins remain at large throughout our body. Once again, the result is a level of risk that prompts chronic inflammation.

On a more temporary, short-term basis, inflammation is part of good health. Whether physical or chemical in nature, whenever our body detects a wound, it typically responds by trying to heal with an inflammatory response. That process is healthy, so long as it is not constant and uninterrupted. But unlike the helpful inflammation that takes place we get a simple cut or bruise, chronic inflammation—when it becomes a standard feature of our metabolism—is incompatible with good health. When our bodies are overwhelmed day in and day out with chronic inflammation, many other metabolic balances can get thrown out of kilter, including the balance in our oxygen metabolism. An unwanted imbalance starts to occur in which too many overly reactive, oxygen-containing molecules are formed. This condition is called oxidative stress. The increased presence of these overly reactive molecules can do damage to many parts of our cells, including their genetic material (and especially their deoxyribonucleic acid, or DNA). Over time, the constant and cumulative DNA damage inside our cells can pose a major risk factor for conversion of healthy cells into cancerous ones.

It's equally possible for this sequence of events to start not with chronic, excessive inflammation, but with chronic oxidative stress. Over time, when overly reactive oxygen-containing molecules cause damage to DNA and other cell structures, our body reads this situation as being highly dangerous and it initiates an inflammatory response to try and reduce the threat posed by the oxidative stress. In either case, we end up with a combination of inadequate detoxification of toxic substances, chronic inflammation and oxidative stress that puts us at greater risk for developing cancer.

In a way that might be unique among foods, the nutrients found in broccoli are able to change this set of connections between inflammation, oxidative stress, detox and cancer. In fact, it would be fair to describe broccoli as containing anti-inflammatory nutrients, antioxidant nutrients, detox-support nutrients, and anti-cancer nutrients as well!

Broccoli's Anti-Inflammatory Benefits

When threatened with dangerous levels of potential toxins, or dangerous numbers of overly-reactive, oxygen-containing molecules, signals are sent within our body to our inflammatory system, directing it to "kick in" and help protect our body from potential damage. One key signaling device is a molecule called Nf-kappaB. When faced with the type of dangers described above, the NF-kappaB signaling system is used to "rev up" our inflammatory response and increase production of inflammatory components (for example, IL-6, IL-1beta, TNF-alpha, iNOS and COX-2). This process works beautifully in temporary, short-term circumstances when healing from injury is required. When it continues indefinitely at a constant pace, however, it can put us at risk for serious health problems, including the development of cancer.

Research studies have made it clear that the NF-kappaB signaling system that is used to "rev up" our inflammatory response can be significantly suppressed by isothiocyanates (ITCs). ITCs—the compounds made from glucosinolates found in broccoli and other cruciferous vegetables—actually help to shut down the genetic machinery used to produce NF-kappaB and other components of the inflammatory system. These anti-inflammatory benefits of ITCs have been demonstrated in the laboratory, and with consumption of the ITCs themselves. While they have yet to be demonstrated on consumption of broccoli in an everyday diet, we fully expect future research to show anti-inflammatory benefits from the routine consumption of broccoli (and its glucosinolates), not just from consumption of ITCs.

Lack of omega-3 fat is dietary problem that can cause over-activation of the inflammatory system. The reason is simple: many key anti-inflammatory messaging molecules (like PGH3, TXA3, PGI3, and LTE5) are made from omega-3 fats. We are not accustomed to thinking about non-fatty vegetables as sources of omega-3 fats, but we need to change our thinking in this area. While it is true that there are limited amounts of omega-3s in vegetables like broccoli, it is equally true that their levels of omega-3s can still play an important role in balancing our inflammatory system activity. In 100 calories' worth of broccoli (about 2 cups) there are approximately 400 milligrams of omega-3s (in the form of alpha-linolenic acid, or ALA). That amount of ALA falls into the same general ballpark as the amount provided by one soft gel capsule of flax oil. While we would not want to depend on broccoli as our sole source of dietary omega-3s, we still get important anti-inflammatory benefits from the omega-3s it provides.

As mentioned earlier in this section, chronic inflammation can sometimes get triggered by overexposure to allergy-related substances. In this context, broccoli has yet another anti-inflammatory trick up its sleeve, because it is a rich source of one particular phytonutrient (a flavonol) called kaempferol. Especially inside of our digestive tract, kaempferol has the ability to lessen the impact of allergy-related substances (by lowering the immune system's production of IgE-antibodies). By lessening the impact of allergy-related substances, the kaempferol in broccoli can help lower our risk of chronic inflammation.

Broccoli's Antioxidant Benefits

Amongst all of the commonly consumed cruciferous vegetables, broccoli stands out as the most concentrated source of a premiere antioxidant nutrient—vitamin C. This central antioxidant vitamin can provide longer-term support of oxygen metabolism in the body if it is accompanied by flavonoids that allow it to recycle. Broccoli provides many such flavonoids in significant amounts, including the flavonoids kaempferol and quercitin. Also concentrated in broccoli are the carotenoids lutein, zeaxanthin, and beta-carotene. All three of these carotenoids function as key antioxidants. In the case of lutein and beta-carotene, broccoli has been shown not only to provide significant amounts of these antioxidants but to significantly increase their blood levels when consumed in the amount of three cups. Other antioxidants provided by broccoli in beneficial amounts include vitamin E and the minerals manganese and zinc.

Considered as a group, the vitamins, minerals, flavonoids, and carotenoids contained in broccoli work to lower risk of oxidative stress in the body. The ability of these nutrients to support oxygen metabolism and avoid excess formation of overly reactive, oxygen-containing molecules makes them equally helpful in lowering risk of chronic inflammation and risk of cancer. If cancer development is compared to a 3-legged stool, the antioxidant benefits of broccoli can be viewed as weakening one leg of the stool, namely the leg called "oxidative stress." We've already seen how the glucosinolates and omega-3 fats in broccoli can be viewed as helping to weaken a second leg of the stool (chronic inflammation). In the next section, we'll look at a third leg of the stool (inadequate detoxification) and see how the nutrients found in broccoli can serve to weaken this leg as well.

Broccoli Can Enhance Detoxification

Most toxins that pose a risk to our cells must be detoxified in our body by a 2-step process. What's remarkable about broccoli is its ability to alter activity in both of these two detox steps. Isothiocyanates (ITCs) made from the glucosinolates in broccoli are well-documented modifiers of the first step in detoxification (called Phase I). In fact, some ITCs like sulforaphane can actually help shut down the genetic machinery that produces certain Phase I enzymes. ITCs are equally capable of altering the activity of enzymes involved in the second step of detoxification (called Phase II). From research in the field of genetics, we know that ITCs can help bridge gaps in Phase II activity when it is insufficient. Taken in combination, the impact of ITCs on Phase I and II detox events is unique—and equally unique is the presence of glucosinolate compounds in broccoli that can be used to make ITCs. Glucosinolates like glucoraphanin, gluconasturtiian, and glucobrassicin are simply not found in other foods in the same combination and concentration that is offered by broccoli. By helping to promote as well as regulate detox activity in our cells, the ITCs made from broccoli can help prevent insufficient detoxification of dangerous substances that threaten our cells.

Broccoli and Cancer Prevention

The unique combination of antioxidant, anti-inflammatory, and pro-detoxification components in broccoli make it a unique food in terms of cancer prevention. Connections between cancer development and oxidative stress, chronic inflammation, and inadequate detoxification are so well-documented in the research that any food improving all three of these metabolic problems would be highly likely to lower our risk of cancer. In the case of broccoli, the research is strongest in showing decreased risk of prostate cancer, colon cancer, breast cancer, bladder cancer, and ovarian cancer. We expect that risk of other cancer types will also eventually be shown to undergo reduction from regular consumption of broccoli.

How Much Broccoli Is Needed for Cancer Prevention?

Recent studies have also provided us with a much better idea about the amount of broccoli that we need to lower our cancer risk. At the lower end of the spectrum, it looks like an average of 1/2 cup of broccoli per day—only 22 calories' worth of broccoli!—is enough to provide some measurable benefits. Few people have broccoli on a daily basis. But a 2-cup serving twice a week would still meet this minimum average amount. It's important to remember how little this amount actually in within the context of one week's food. A person eating 2,000 calories per day would be consuming 14,000 calories per week. A 2-cup serving of broccoli twice a week would provide about 178 calories—only 1% of the total weekly calories! At the higher end of the spectrum, studies show that more broccoli might be needed to accomplish other cancer-preventing tasks. For example, one study showed significantly higher urinary excretion of potential carcinogens from well-done, grilled meats given daily consumption of broccoli in the range of 9 ounces (250 grams) per day. That gram amount corresponds to approximately 1.6 cups of broccoli on a daily basis. We've also seen a study showing that "generous" amounts of broccoli can help optimize levels of antioxidants in the blood, especially beta-carotene and lutein. (Optimal antioxidant levels can help lower the risk of oxidative stress in healthy cells, which also helps lower their risk of becoming cancerous.) In this study, the term "generous" was used to describe consumption of broccoli in the amount of 3 cups daily. Once again, that amount would not be ridiculously high in terms of calories—3 cups would provide about 132 calories, or 6-7% of a 2,000-calorie diet. But it might be a greater amount that many people would want to consume on a regular basis.

For us, the bottom line here is not to treat broccoli like garnish. In recipes like our Asian-Flavored Broccoli with Tofu or 5-Minute Broccoli with Feta Cheese and Kalamata Olives recipes, we use 1 pound of broccoli to provide two servings. That's approximately 1.5 cups of broccoli per serving. There is no reason to shy away from 2-3 cup servings of broccoli when enjoying this cruciferous vegetable, especially if you want to optimize its cancer-preventing benefits. But make sure you're not simply "decorating" your plate with single broccoli stalk and floret.

Broccoli and Digestive Support

The digestive support provided by broccoli falls into two basic categories: fiber support, and ITC (isothiocyanate) support. At approximately 1 gram of dietary fiber for every 10 calories, you don't have to eat much broccoli to get a large amount of your daily requirement! For 100 calories—only 5% of a 2,000-calorie diet—you get about 10 grams of fiber, or 40% of the Daily Value (DV). And, 250 calories of broccoli (about 12% of a 2,000-calorie diet) will give you the full daily requirement for this important nutrient! Few components of food support our digestive system as well as fiber. The speed that food travels through us, the consistency of food as it moves through our intestine, and bacterial populations in our intestine are all supported as well as regulated by dietary fiber.

Alongside of broccoli's dietary fibers are its glucosinolates. These phytonutrients are converted by our bodies into isothiocyanates (ITCs). ITCs—and particularly sulforaphane—help protect the health of our stomach lining by helping prevent bacterial overgrowth of Helicobacter pylori or too much clinging by this bacterium to our stomach wall. Broccoli sprouts appear to have especially strong stomach support properties in this regard.

Broccoli and Cardiovascular Support

Although research in this area is still in the early stages, anti-inflammatory substances found in cruciferous vegetables are becoming the topic of increasing interest with respect to heart disease. One particular focus here involves the anti-inflammatory properties of sulforaphane, one of the isothiocyanates (ITCs) derived from the glucoraphanin in broccoli. In some individuals susceptible to high blood sugar, sulforaphane may be able to prevent (or even reverse) some of the damage to blood vessel linings that can be cause by chronic blood sugar problems. Decreased risk of heart attacks and strokes may also eventually be linked in a statistically significant way to intake of broccoli and its glucoraphanin.

A second area you can count on broccoli for cardiovascular support involves its cholesterol-lowering ability. Our liver uses cholesterol as a basic building block to product bile acids. Bile acids are specialized molecules that aid in the digestion and absorption of fat through a process called emulsification. These molecules are typically stored in fluid form in our gall bladder, and when we eat a fat-containing meal, they get released into the intestine where they help ready the fat for interaction with enzymes and eventual absorption up into the body. When we eat broccoli, fiber-related nutrients in this cruciferous vegetable bind together with some of the bile acids in the intestine in such a way that they simply stay inside the intestine and pass out of our body in a bowel movement, rather than getting absorbed along with the fat they have emulsified. When this happens, our liver needs to replace the lost bile acids by drawing upon our existing supply of cholesterol, and as a result, our cholesterol level drops down. Broccoli provides us with this cholesterol-lowering benefit whether it is raw or cooked. However, a recent study has shown that the cholesterol-lowering ability of raw broccoli improves significantly when it is steamed. In fact, when the cholesterol-lowering ability of steamed broccoli was compared with the cholesterol-lowering ability of the prescription drug cholestyramine (a medication that is taken for the purpose of lowering cholesterol), broccoli bound 33% as many bile acids (based on a standard of comparison involving total dietary fiber).

The B-complex vitamins in broccoli can also make a major contribution to our cardiovascular health. Especially with respect to excessive formation of homocysteine—an event which raises our risk of atherosclerosis, stroke, and heart attack—B-complex vitamin deficiency intake can pose a major risk. Three B vitamins especially important for lowering our risk of hyperhomocysteinemia (excessive formation of homocysteine) are vitamin B6, vitamin B12, and folate. By making an important contribution to our B6 and folate intake, broccoli can help us lower our risk of excessive homocysteine formation and cardiovascular problems that are related to excess homocysteine.

Other Health Benefits Provided by Broccoli

Three other areas of health benefits are important to mention when considering broccoli and its unique combination of nutrients. The first area is eye health. Two carotenoids found in significant concentrations in broccoli—lutein and zeaxanthin—play an especially important role in the health of the eye. In fact, no tissue in the body is more concentrated with lutein than the area in the outer portion of the retina (called the peripheral retina). Similarly, in the macula near the central portion of the retina, zeaxanthin is uniquely concentrated. Risk of problems involving the macula of the eye (for example, macular degeneration) and problems involving the lens area of the eye (for example, cataracts) have both been show to lessen with intake of foods (including broccoli) that provide significant amounts of the lutein and zeaxanthin carotenonids.

A second area is skin support, including support of sun-damaged skin. Here it is the glucoraphanin found in broccoli—converted into sulforaphane by the body—that has received the most research attention. Since skin cells can carry out the process of detoxification, it may be detox-related benefits of sulforaphane that are especially important in helping to counteract sun damage.

A third area of increasing research interest involves the metabolism of vitamin D. Broccoli is not a source of this vitamin, but it is an excellent source of vitamin K and also of vitamin A (in one of its precursor forms, beta-carotene). Many individuals have large vitamin D deficiencies that cannot be remedied through diet alone, and these deficiencies require sizable amounts of vitamin D to be provided through dietary supplementation. When large supplemental doses of vitamin D are needed to offset deficiency, ample supplies of vitamin K and vitamin A appear to help keep our vitamin D metabolism in the proper balance. Assuring adequate intake of vitamins K and A alongside of vitamin D supplementation may turn out to be important in achieving optimal vitamin D supplementation results and avoiding potential problems related to supplementation. Broccoli may turn out to play a particularly helpful role in balancing this set of events by providing its unusually strong combination of both vitamin A and vitamin K.

Description

Broccoli is a member of the cabbage family, and is closely related to cauliflower. Its cultivation originated in Italy. *Broccolo*, its Italian name, means "cabbage sprout." Broccoli's name is derived from the Latin word brachium, which means branch or arm, a reflection of its tree-like shape that features a compact head of florets attached by small stems to a larger stalk. Because of its different components, this vegetable provides a complex of tastes and textures, ranging from soft and flowery (the florets) to fibrous and crunchy (the stem and stalk). Its color can range from deep sage to dark green to purplish-green, depending upon the variety. One of the most popular types of broccoli sold in North America is known as Italian green, or Calabrese, named after the Italian province of Calabria where it first grew.

Other vegetables related to broccoli are broccolini, a mix between broccoli and *gai-lin* (Chinese broccoli), and broccoflower, a cross between broccoli and cauliflower. Broccoli sprouts have also recently become popular as a result of research uncovering their high concentration of the anti-cancer phytonutrient, sulforaphane.

History

Broccoli has its roots in Italy. In ancient Roman times, it was developed from wild cabbage, a plant that more resembles collards than broccoli. It spread through out the Near East where it was appreciated for its edible flower heads and was subsequently brought back to Italy where it was further cultivated. Broccoli was introduced to the United States in colonial times, popularized by Italian immigrants who brought this prized vegetable with them to the New World.

How to Select and Store

Choose broccoli with floret clusters that are compact and not bruised. They should be uniformly colored, either dark green, sage or purple-green, depending upon variety, and with no yellowing. In addition, they should not have any yellow flowers blossoming through, as this is a sign of over maturity. The stalk and stems should be firm with no slimy spots appearing either there or on the florets. If leaves are attached, they should be vibrant in color and not wilted.

Place broccoli in a plastic bag, removing as much of the air from the bag as possible. Store in the refrigerator where it will keep for 10 days. Loss of some nutrients in broccoli—for example, its vitamin C content—is likely to be slowed down through refrigeration.

Do not wash broccoli before storing because exposure to water encourages spoilage. Partial heads of broccoli should be placed in a well-sealed container or plastic bag and refrigerated. Since the vitamin C content starts to quickly degrade once broccoli has been cut, it is best to use it within a couple of days. Broccoli that has been blanched and then frozen can stay up to a year. Leftover cooked broccoli should be placed in tightly covered container and stored in the refrigerator where it will keep for a few days.

How to Enjoy

A Few Quick Serving Ideas

- Toss pasta with olive oil, pine nuts and steamed broccoli florets. Add salt and pepper to taste.
- Purée cooked broccoli and cauliflower, then combine with seasonings of your choice to make a simple, yet delicious, soup.
- Add broccoli florets and chopped stalks to omelets.

WHFoods Recipes That Feature Broccoli

- Asian-Flavored Broccoli with Tofu
- Miso Stir-Fry
- Sweet N' Sour Cod with Cabbage and Broccoli

Safety

Broccoli and Goitrogens

You may sometimes hear broccoli being described as a food that contains "goitrogens," or as a food that is "goitrogenic." For helpful information in this area—including our WHFoods Recommendations—please see our article What is meant by the term "goitrogen" and what is the connection between goitrogens, food, and health?.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Broccoli, chopped, cooked
1.00 cup
156.00 grams

Calories: 55
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin K	220.12 mcg	245	80.6	excellent
vitamin C	101.24 mg	135	44.5	excellent
chromium	18.55 mcg	53	17.5	excellent
folate	168.48 mcg	42	13.9	excellent
fiber	5.15 g	21	6.8	very good
pantothenic acid	0.96 mg	19	6.3	very good
vitamin B6	0.31 mg	18	6.0	very good
vitamin E	2.26 mg (ATE)	15	5.0	very good
manganese	0.30 mg	15	4.9	very good
phosphorus	104.52 mg	15	4.9	very good
choline	62.56 mg	15	4.9	very good
vitamin B2	0.19 mg	15	4.8	very good
vitamin A	120.74 mcg RAE	13	4.4	very good
potassium	457.08 mg	13	4.3	very good
copper	0.10 mg	11	3.7	very good
vitamin B1	0.10 mg	8	2.7	good
magnesium	32.76 mg	8	2.7	good
omega-3 fats	0.19 g	8	2.6	good
protein	3.71 g	7	2.4	good
zinc	0.70 mg	6	2.1	good
calcium	62.40 mg	6	2.1	good
iron	1.05 mg	6	1.9	good
vitamin B3	0.86 mg	5	1.8	good
selenium	2.50 mcg	5	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Brussels sprouts

What's New and Beneficial About Brussels Sprouts

- Brussels sprouts can provide you with some special cholesterol-lowering benefits if you will use a steaming method when cooking them. The fiber-related components in Brussels sprouts do a better job of binding together with bile acids in your digestive tract when they've been steamed. When this binding process takes place, it's easier for bile acids to be excreted, and the result is a lowering of your cholesterol levels. Raw Brussels sprouts still have cholesterol-lowering ability — just not as much as steamed Brussels sprouts.
- Brussels sprouts may have unique health benefits in the area of DNA protection. A recent study has shown improved stability of DNA inside of our white blood cells after daily consumption of Brussels sprouts in the amount of 1.25 cups. Interestingly, it's the ability of certain compounds in Brussels sprouts to block the activity of sulphotransferase enzymes that researchers believe to be responsible for these DNA-protective benefits.
- For total glucosinolate content, Brussels sprouts are now known to top the list of commonly eaten cruciferous vegetables. Their total glucosinolate content has been shown to be greater than the amount found in mustard greens, turnip greens, cabbage, kale, cauliflower, or broccoli. In Germany, Brussels sprouts account for more glucosinolate intake than any other food except broccoli. Glucosinolates are important phytonutrients for our health because they are the chemical starting points for a variety of cancer-protective substances. All cruciferous vegetables contain glucosinolates and have great health benefits for this reason. But it's recent research that's made us realize how especially valuable Brussels sprouts are in this regard.
- The cancer protection we get from Brussels sprouts is largely related to four specific glucosinolates found in this cruciferous vegetable: glucoraphanin, glucobrassicin, sinigrin, and gluconasturtiian. Research has shown that Brussels sprouts offer these cancer-preventive components in special combination.
- Brussels sprouts have been used to determine the potential impact of cruciferous vegetables on thyroid function. In a recent study, 5 ounces of Brussels sprouts were consumed on a daily basis for 4 consecutive weeks by a small group of healthy adults and not found to have an unwanted impact on their thyroid function. Although follow-up studies are needed, this study puts at least one large stamp of approval on Brussels sprouts as a food that can provide fantastic health benefits without putting the thyroid gland at risk.

WHFoods Recommendations

You'll want to include Brussels sprouts as one of the cruciferous vegetables you eat on a regular basis if you want to receive the fantastic health benefits provided by the cruciferous vegetable family. At a minimum, we recommend 3/4 cup of cruciferous vegetables on a daily basis. This amount is equivalent to approximately 5 cups per week. A more optimal intake amount would be 1-1/2 cups per day, or about 10 cups per week. You can use our Veggie Advisor for help in figuring out your best cruciferous vegetable options.

It is very important not to overcook Brussels sprouts. Not only do they lose their nutritional value and taste but they will begin to emit the unpleasant sulfur smell associated with overcooked cruciferous vegetables. To help Brussels sprouts cook more quickly and evenly cut each sprout into quarters. Let them sit for at least 5 minutes to bring out the health-promoting qualities and then steam them for 5 minutes. Serve with our Honey Mustard Dressing to add extra tang and flavor to Brussels sprouts.

Brussels Sprouts, cooked
1.00 cup
(156.00 grams)

Calories: 56
GI: very low

Nutrient	DRI/DV
vitamin K	243%
vitamin C	129%
folate	23%
manganese	18%
fiber	16%
vitamin B6	16%
choline	15%
vitamin B1	14%
copper	14%
potassium	14%
phosphorus	12%

omega-3 fats	11%
iron	10%
vitamin B2	9%
pantothenic acid	8%
magnesium	8%
protein	8%
vitamin A	7%
vitamin B3	6%
calcium	6%
zinc	5%

Health Benefits

You'll find nearly 100 studies in PubMed (the health research database at the National Library of Medicine in Washington, D.C.) that are focused on Brussels sprouts, and over half of those studies involve the health benefits of this cruciferous vegetable in relationship to cancer. This connection between Brussels sprouts and cancer prevention should not be surprising since Brussels sprouts provide special nutrient support for three body systems that are closely connected with cancer development as well as cancer prevention. These three systems are (1) the body's detox system, (2) its antioxidant system, and (3) its inflammatory/anti-inflammatory system. Chronic imbalances in any of these three systems can increase risk of cancer, and when imbalances in all three systems occur simultaneously, the risk of cancer increases significantly. Among all types of cancer, prevention of the following cancer types is most closely associated with intake of Brussels sprouts: bladder cancer, breast cancer, colon cancer, lung cancer, prostate cancer, and ovarian cancer.

Brussels Sprouts and Detox Support

The detox support provided by Brussels sprouts is both complicated and extensive. First, there is evidence from human studies that enzyme systems in our cells required for detoxification of cancer-causing substances can be activated by compounds made from glucosinolates found in Brussels sprouts. Brussels sprouts are an outstanding source of glucosinolates. The chart below shows the best studied of the glucosinolates found in Brussels sprouts and the detox-activating substances (called isothiocyanates) made from them.

Glucosinolates in Brussels sprouts and their detox-activating isothiocyanates

Glucosinolate	Derived Isothiocyanate	Isothiocyanate Abbreviation
glucoraphanin	sulforaphane	SFN
glucobrassicin	indole-3-carbinol*	I3C
sinigrin	allyl-isothiocyanate	AITC
gluconasturtiian	phenethyl-isothiocyanate	PEITC

* Indole-3-carbinol (I3C) is not an isothiocyanate. It's a benzopyrrole, and it is only formed when isothiocyanates made from glucobrassicin are further broken down into non-sulfur containing compounds.

Second, the body's detox system requires ample supplies of sulfur to work effectively, and Brussels sprouts are rich in sulfur-containing nutrients. Sulfur is connected with both the smell and taste of Brussels sprouts, and too much sulfur aroma is often associated with overcooking of this vegetable. Sulfur-containing nutrients help support what is commonly referred to as Phase 2 of detoxification. Third, our body's detox system needs strong antioxidant support—especially during what is called Phase 1 of detoxification. Brussels sprouts are able to provide that kind of support because they are an excellent source of vitamin C and a very good source of manganese. Brussels sprouts also contain a wide variety of antioxidant phytonutrients, including many antioxidant flavonoids. Finally, there is evidence that the DNA in our cells is protected by naturally occurring substances in Brussels sprouts, and since many environmental toxins can trigger unwanted change in our DNA, Brussels sprouts can help prevent these toxin-triggered DNA changes.

Brussels Sprouts and Antioxidant Support

As mentioned earlier, Brussels sprouts are an important dietary source of many vitamin antioxidants, including vitamins C and A (in the form of beta-carotene). The antioxidant mineral manganese is also provided by Brussels sprouts. Flavonoid antioxidants like isorhamnetin, quercitin, and kaempferol are also found in Brussels sprouts, as are the antioxidants caffeic acid and ferulic acid. In fact, one study examining total intake of antioxidant polyphenols in France found Brussels sprouts to be a more important dietary contributor to these antioxidants than any other cruciferous vegetable, including broccoli. Some of the antioxidant compounds found in Brussels sprouts may be somewhat rare in foods overall. One such compound is a sulfur-containing compound called D3T. (D3T is the abbreviated name for 3H-1,2-dithiole-3-thione.) Researchers continue to investigate ways in which D3T is able to optimize responses by our body's antioxidant system.

Treated as a group, the antioxidant nutrients described above provide support not only for Phase 1 of the body's detoxification process but also for all of the body's cells that are at risk of oxidative damage from overly reactive oxygen-containing molecules. Chronic oxidative stress—meaning chronic presence of overly reactive oxygen-containing molecules and cumulative damage to tissue by these molecules — is a risk factor for the development of most cancer types.

Brussels Sprouts and Inflammatory/Anti-inflammatory Support

Like chronic oxidative stress, chronic unwanted inflammation is also a risk factor for many types of cancer. Exposure to environmental toxins, chronic overuse of prescription or over-the-counter medications, chronic excessive stress, chronic lack of exercise, chronic lack of sleep, and a low quality diet can all contribute to our risk of unwanted inflammation.

Brussels sprouts can help us avoid chronic, excessive inflammation through a variety of nutrient benefits. First is their rich glucosinolate content. In addition to the detox-supportive properties mentioned earlier, glucosinolates found in Brussels sprouts help to regulate the body's inflammatory/anti-inflammatory system and prevent unwanted inflammation. Particularly well-studied in this context is the glucosinolate called glucobrassicin. The glucobrassicin found in Brussels sprouts can get converted into an isothiocyanate molecule called ITC, or indole-3-carbinol. I3C is an anti-inflammatory compound that can actually operate at the genetic level, and by doing so, prevent the initiation of inflammatory responses at a very early stage.

A second important anti-inflammatory nutrient found in Brussels sprouts is vitamin K. Vitamin K is a direct regulator of inflammatory responses, and we need optimal intake of this vitamin in order to avoid chronic, excessive inflammation.

A third important anti-inflammatory component in Brussels sprouts is not one that you might expect. It's their omega-3 fatty acids. We don't tend to think about vegetables in general as important sources of omega-3s, and certainly no vegetables that are as low in total fat as Brussels sprouts. But 100 calories' worth of Brussels sprouts (about 1.5 cups) provide about 480 milligrams of the most basic omega-3 fatty acid (called alpha-linolenic acid, or ALA). That amount is more than one-third of the daily ALA amount recommended by the National Academy of Sciences in the Dietary Reference Intake recommendations, and it's about half of the ALA contained in one teaspoon of whole flaxseeds. Omega-3 fatty acids are the building blocks for the one of the body's most effective families of anti-inflammatory messaging molecules.

Brussels Sprouts and Cardiovascular Support

Researchers have looked at a variety of cardiovascular problems — including heart attack, ischemic heart disease, and atherosclerosis — and found preliminary evidence of an ability on the part of cruciferous vegetables to lower our risk of these health problems. Yet regardless of the specific cardiovascular problem, it is one particular type of cardiovascular benefit that has most interested researchers, and that benefit is the anti-inflammatory nature of Brussels sprouts and their fellow cruciferous vegetables. Scientists have not always viewed cardiovascular problems as having a central inflammatory component, but the role of unwanted inflammation in creating problems for our blood vessels and circulation has become increasingly fundamental to an understanding of cardiovascular diseases. Of particular interest here has been the isothiocyanate (ITC) sulforaphane, which is made from glucoraphanin (a glucosinolate) found in Brussels sprouts. Not only does this ITC trigger anti-inflammatory activity in our cardiovascular system — it may also be able to help prevent and even possibly help reverse blood vessel damage.

A second area you can count on Brussels sprouts for cardiovascular support involves their cholesterol-lowering ability. Our liver uses cholesterol as a basic building block to product bile acids. Bile acids are specialized molecules that aid in the digestion and absorption of fat through a process called emulsification. These molecules are typically stored in fluid form in our gall bladder, and when we eat a fat-containing meal, they get released into the intestine where they help ready the fat for interaction with enzymes and eventual absorption up into the body. When we eat Brussels sprouts, fiber-related nutrients in this cruciferous vegetable bind together with some of the bile acids in the intestine in such a way that they simply stay inside the intestine and pass out of our body in a bowel movement rather than getting absorbed along with the fat they have emulsified. When this happens, our liver needs to replace the lost bile acids by drawing upon our existing supply of cholesterol, and, as a result, our cholesterol level drops down. Brussels sprouts provide us with this cholesterol-lowering benefit whether they are raw or cooked. However, a recent study has shown that the cholesterol-lowering ability of raw Brussels sprouts improves significantly when they are steamed. In fact, when the cholesterol-lowering ability of steamed Brussels sprouts was compared with the cholesterol-lowering ability of the prescription drug cholestyramine (a medication that is taken for the purpose of lowering cholesterol), Brussels sprouts bound 27% as many bile acids (on a total dietary fiber basis).

Brussels Sprouts and Digestive Support

The fiber content of Brussels sprouts — 4 grams in every cup — makes this cruciferous vegetable a natural choice for digestive system support. You're going to get half of your Daily Value for fiber from only 200 calories' worth of Brussels sprouts. Yet the fiber content of Brussels sprouts is only one of their digestive support mechanisms. Researchers have determined that the sulforaphane made from Brussels sprouts' glucoraphanin helps protect the health of our stomach lining by preventing bacterial overgrowth of Helicobacter pylori in our stomach or too much clinging by this bacterium to our stomach wall.

Other Health Benefits from Brussels Sprouts

The anti-inflammatory nature of glucosinolates/isothiocyanates and other nutrients found in Brussels sprouts has been the basis for new research on inflammation-related health problems and the potential role of Brussels sprouts in their prevention. Current and potentially promising research is underway to examine the benefits of Brussels sprouts in relationship to our risk of the following inflammation-related conditions: Crohn's disease, inflammatory bowel disease, insulin resistance, irritable bowel syndrome, metabolic syndrome, obesity, rheumatoid arthritis, type 2 diabetes, and ulcerative colitis.

Description

All cruciferous vegetables provide integrated nourishment across a wide variety of nutritional categories and provide broad support across a wide variety of body systems as well. For more on cruciferous vegetables see:

- Eating Healthy with Cruciferous Vegetables
- Feeling Great with Cruciferous Vegetables

Brussels sprouts are members of the Brassica family and therefore kin to broccoli and cabbage. They resemble miniature cabbages, with diameters of about 1 inch. They grow in bunches of 20 to 40 on the stem of a plant that grows as high as three feet tall. Brussels sprouts are typically sage green in color, although some varieties feature a red hue. They are oftentimes sold separately but can sometimes be found in stores still attached to the stem. Perfectly cooked Brussels sprouts have a crisp, dense texture and a slightly sweet, bright, and "green" taste.

It's no surprise that Brussels sprouts look like perfect miniature versions of cabbage since they are closely related, both belong to the Brassica family of vegetables. Brussels sprouts are available year round; however, they are at their best from autumn through early spring when they are at the peak of their growing season.

History

While the origins of Brussels sprouts are unknown, the first mention of them can be traced to the late 16th century. They are thought to be native to Belgium, specifically to a region near its capital, Brussels, after which they are named. They remained a local crop in this area until their use spread across Europe during World War I. Brussels sprouts are now cultivated throughout Europe and the United States. In the U.S., almost all Brussels sprouts are grown in California.

How to Select and Store

Good quality Brussels sprouts are firm, compact, and vivid green. They should be free of yellowed or wilted leaves and should not be puffy or soft in texture. Avoid those that have perforations in their leaves as this may indicate that they have aphids residing within. If Brussels sprouts are sold individually, choose those of equal size to ensure that they will cook evenly. Brussels sprouts are available year round, but their peak growing period is from autumn until early spring.

Keep unwashed and untrimmed Brussels sprouts in the vegetable compartment of the refrigerator. Loss of some nutrients in Brussels sprouts—for example, its vitamin C content—is likely to be slowed down through refrigeration. Stored in a plastic bag, they can be kept for 10 days. If you want to freeze Brussels sprouts, steam them first for between three to five minutes. They will keep in the freezer for up to one year.

How to Enjoy

A Few Quick Serving Ideas

- Since cooked Brussels sprouts are small and compact, they make a great snack food that can be simply eaten as is or seasoned with salt and pepper to taste.
- Combine quartered cooked Brussels sprouts with sliced red onions, walnuts, and your favorite mild tasting cheese such as a goat cheese or feta. Toss with olive oil and balsamic vinegar for an exceptionally healthy, delicious side dish or salad.

WHFoods Recipes That Feature Brussels Sprouts

- 5-Minute Brussels Sprouts

Safety

Brussels Sprouts and Goitrogens

You may sometimes hear Brussels sprouts being described as a food that contains "goitrogens," or as a food that is "goitrogenic." For helpful information in this area—including our WHFoods Recommendations—please see our article What is meant by the term "goitrogen" and what is the connection between goitrogens, food, and health?.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Brussels Sprouts, cooked 1.00 cup 156.00 grams				**Calories: 56 GI: very low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin K	218.87 mcg	243	77.9	excellent
vitamin C	96.72 mg	129	41.3	excellent
folate	93.60 mcg	23	7.5	very good
manganese	0.35 mg	18	5.6	very good
vitamin B6	0.28 mg	16	5.3	very good
fiber	4.06 g	16	5.2	very good
choline	63.34 mg	15	4.8	very good
copper	0.13 mg	14	4.6	very good
vitamin B1	0.17 mg	14	4.5	very good
potassium	494.52 mg	14	4.5	very good
phosphorus	87.36 mg	12	4.0	very good
omega-3 fats	0.27 g	11	3.6	very good
iron	1.87 mg	10	3.3	good
vitamin B2	0.12 mg	9	3.0	good
protein	3.98 g	8	2.6	good
pantothenic acid	0.39 mg	8	2.5	good

magnesium	31.20 mg	8	2.5	good
vitamin A	60.45 mcg RAE	7	2.2	good
vitamin B3	0.95 mg	6	1.9	good
calcium	56.16 mg	6	1.8	good
zinc	0.51 mg	5	1.5	good

World's Healthiest Foods Rating	**Rule**
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Cabbage

What's New and Beneficial About Cabbage

- Cabbage can provide you with some special cholesterol-lowering benefits if you will cook it by steaming. The fiber-related components in cabbage do a better job of binding together with bile acids in your digestive tract when they've been steamed. When this binding process takes place, it's easier for bile acids to be excreted, and the result is a lowering of your cholesterol levels. Raw cabbage still has cholesterol-lowering ability, just not as much as steamed cabbage.
- Researchers now realize that different types of cabbage (red, green, and Savoy) contain different patterns of glucosinolates. This new knowledge means that your broadest health benefits from cabbage are likely to come from inclusion of all varieties in your diet.
- Cabbage in general—but also Savoy cabbage in particular—turns out to be an especially good source of sinigrin. Sinigrin is one of the cabbage glucosinolates that has received special attention in cancer prevention research. The sinigrin in cabbage can be converted into allyl-isothiocyanate, or AITC. This isothiocyanate compound has shown unique cancer preventive properties with respect to bladder cancer, colon cancer, and prostate cancer.
- In one recent study, short-cooked and raw cabbage were the only types of cabbage to show cancer-preventive benefits—long-cooked cabbage failed to demonstrate measurable benefits.
- Our Healthy Sauté method, which we recommend for cabbage, is very similar to steaming and enhances the flavor the of cabbage. See "How to Enjoy" below.

WHFoods Recommendations

You'll want to include cabbage as one of the cruciferous vegetables you eat on a regular basis if you want to receive the fantastic health benefits provided by the cruciferous vegetable family. At a minimum, we recommend 3/4 cup of cruciferous vegetables on a daily basis. This amount is equivalent to approximately 5 cups per week. A more optimal intake amount would be 1-1/2 cups per day, or about 10 cups per week. You can use our Veggie Advisor for help in figuring out your best cruciferous vegetable options.

Traditional methods of steaming or boiling make cabbage watery. To retain the maximum number of nutrients and flavor we recommend Healthy Sautéeing cabbage. Slice cabbage into 1/4-inch slices and let sit for 5 minutes to enhance its health-promoting benefits before cooking. For more details see Healthiest Way of Cooking Cabbage below.

Our Chinese Chicken Cabbage Salad recipe is a great example of how to enjoy the delicate flavor of napa cabbage in your favorite salad. It is a milder tasting variety of cabbage that boasts the highest concentration of folate.

Enjoy the mild flavor of bok choy by using our Healthy Sauté method of cooking. Our 4-Minute Healthy Sautéed Bok Choy recipe will give you great tasting bok choy in a matter of minutes!

Red Cabbage

While green cabbage is the most commonly eaten variety of cabbage, we highly recommend trying red cabbage because of its added nutritional benefits and its robust hearty flavor. We don't think you will be disappointed. The rich red color of red cabbage reflects its concentration of anthocyanin polyphenols, which contribute to red cabbage containing significantly more protective phytonutrients than green cabbage. Interest in anthocyanin pigments continues to intensify because of their health benefits as dietary antioxidants, as an anti-inflammatory, and their potentially protective, preventative, and therapeutic roles in a number of human diseases.

A recent study showed that a 100 gram (about 3 ounces) serving of raw red cabbage delivers 196.5 milligrams of polyphenols, of which 28.3 milligrams are anthocyanins. Green cabbages yielded much less per 100 grams: 45 milligrams of polyphenols including 0.01 milligram of anthocyanins. The vitamin C equivalent, a measure of antioxidant capacity, of red cabbage is also six to eight times higher than that of green cabbage. Red cabbage is one of the most nutritious and best tasting vegetables around — a great addition to your Healthiest Way of Eating.

Cabbage, red, cooked
1.00 cup
(150.00 grams)

Calories: 44
GI: very low

Nutrient	DRI/DV

vitamin K	79%
vitamin C	69%
vitamin B6	20%
manganese	17%
fiber	16%
potassium	11%
copper	9%
vitamin B1	9%
folate	9%
choline	8%
phosphorus	7%
vitamin B2	7%
selenium	6%
magnesium	6%
iron	6%
calcium	6%
pantothenic acid	5%
protein	5%
vitamin B3	4%

Health Benefits

Cancer prevention tops all other areas of health research with regard to cabbage and its outstanding benefits. More than 475 studies have examined the role of this cruciferous vegetable in cancer prevention (and in some cases, cancer treatment). The uniqueness of cabbage in cancer prevention is due to the three different types of nutrient richness found in this widely enjoyed food. The three types are (1) antioxidant richness, (2) anti-inflammatory richness, and (3) richness in glucosinolates.

Antioxidant-Related Health Benefits

Cabbage ranked in our WHFoods rating system as an excellent source of vitamin C and a very good source of manganese. But in terms of antioxidants in the newer, phytonutrient category, cabbage is impressive, even among cruciferous vegetables. Polyphenols rank at the top of the list for phytonutrient antioxidants in cabbage. In fact, one group of researchers has described polyphenols as the primary factor in cabbage's overall antioxidant capacity. Even white cabbage (a very lightly-colored form of green cabbage and the most commonly eaten variety of cabbage in the U.S.) provides about 50 milligrams of polyphenols in a half-cup serving. Red cabbage is even more unique among the cruciferous vegetables in providing about 30 milligrams of the red pigment polyphenols called anthocyanins in each half cup. (These anthocyanins qualify not only as antioxidant nutrients, but as anti-inflammatory nutrients as well.) The antioxidant richness of cabbage is partly responsible for its cancer prevention benefits. Without sufficient intake of antioxidants, our oxygen metabolism can become compromised, and we can experience a metabolic problem called oxidative stress. Chronic oxidative stress—in and of itself—can be a risk factor for development of cancer.

Anti-Inflammatory Benefits

Without sufficient intake of anti-inflammatory nutrients, regulation of our inflammatory system can become compromised, and we can experience the problem of chronic inflammation. Especially when combined together with oxidative stress, chronic inflammation is a risk factor for development of cancer.

The anthocyanins found in red cabbage are well-documented anti-inflammatory compounds, and make red cabbage a standout anti-inflammatory food for this reason. However, all types of cabbage contain significant amounts of polyphenols that provide anti-inflammatory benefits.

Glucosinolates and Cancer Prevention

Given the roles of oxidative stress and chronic inflammation as risk factors for cancer, the antioxidant and anti-inflammatory richness of cabbage would provide anti-cancer health benefits without the addition of cabbage's glucosinolates. But glucosinolates are cabbage's trump card with regard to "anti-cancer" benefits. The glucosinolates found in cabbage can be converted into isothiocyanate compounds that are cancer preventive for a variety of different cancers, including bladder cancer, breast cancer, colon cancer, and prostate cancer. Different types of cabbage highlight different glucosinolates, as summarized in the chart below:

Glucosinolates in Cabbage and Their Anti-Cancer Thiocyanates

Best Cabbage Source	Glucosinolate	Derived Isothiocyanate	Isothiocyanate Abbreviation
red cabbage	glucoraphanin	sulforaphane	SFN
savoy cabbage	glucobrassicin	indole-3-carbinol*	I3C
savoy and green cabbage	sinigrin	allyl-isothiocyanate	AITC
green cabbage	glucotropaeolin	benzyl-isothiocyanate	BITC

* Indole-3-carbinol (I3C) is not an isothiocyanate. It's a benzopyrrole, and it is only formed when isothiocyanates made from glucobrassicin are further broken down into non-sulfur containing compounds.

The isothiocyanates (ITCs) made from cabbage's glucosinolates act to protect us against cancer through a variety of different mechanisms. In some cases, they help regulate inflammation by altering the activity of messaging molecules within our body's inflammatory system. In other cases, they improve our body's detoxification system and leave our cells with a smaller toxic load. But the bottom line is decreased risk of cancer from consumption of cabbage and its glucosinolates. We've seen one study, from Poland, showing impressive reduction of breast cancer risk in women consuming large amounts of cabbage. (In this particular study, this reduction in risk was associated with consumption of at least 4 cabbage servings per week, in comparison with the once-per-week serving consumed by women with higher breast cancer risk.)

Digestive Tract Support

Long-established in health research is the role of cabbage juice in helping heal stomach ulcers (called peptic ulcers), but more recent studies on cabbage have looked at the overall health benefits of this food for the stomach and digestive tract as a whole. Present-day studies make it clear that cabbage contains a variety of nutrients of potential benefit to our stomach and intestinal linings. These nutrients include glucosinolates (and the anti-inflammatory isothiocyanates or ITCs made from them), antioxidant polyphenols, and the amino acid-like substance called glutamine. In the case of ITCs, digestive tract benefits include proper regulation of bacterial populations of Helicobacter pylori inside the stomach. These bacteria are normal stomach inhabitants, but their populations can become too large and they can latch onto the stomach lining in an undesirable way. The ITCs made from cabbage's glucosinolates can lower the risk of these unwanted stomach events.

Cardiovascular Support

You can count on cabbage to provide your cardiovascular system with valuable support in the form of cholesterol reduction. Researchers understand exactly how this process takes place. Your liver uses cholesterol as a basic building block to produce bile acids. Bile acids are specialized molecules that aid in the digestion and absorption of fat through a process called emulsification. These molecules are typically stored in fluid form in your gall bladder, and when you eat a fat-containing meal, they get released into the intestine where they help ready the fat for interaction with enzymes and eventual absorption up into the body. When you eat cabbage, fiber-related nutrients in this cruciferous vegetable bind together with some of the bile acids in the intestine in such a way that they simply stay inside the intestine and pass out of your body in a bowel movement, rather than getting absorbed along with the fat they have emulsified. When this happens, your liver needs to replace the lost bile acids by drawing upon your existing supply of cholesterol, and as a result, your cholesterol level drops down. Cabbage provides you with this cholesterol-lowering benefit whether it is raw or cooked. However, a recent study has shown that the cholesterol-lowering ability of raw cabbage improves significantly when it is steamed. In fact, when the cholesterol-lowering ability of steamed cabbage was compared with the cholesterol-lowering ability of the prescription drug cholestyramine (a medication that is taken for the purpose of lowering cholesterol), cabbage bound 17% as many bile acids (based on a standard of comparison involving total dietary fiber).

Description

Cabbage has a round shape and is composed of superimposed leaf layers. It is a member of the food family traditionally known as cruciferous vegetables and is related to kale, broccoli, collards and Brussels sprouts. All cruciferous vegetables provide integrated nourishment across a wide variety of nutritional categories and provide broad support across a wide variety of body systems as well. For more on cruciferous vegetables see:

- Eating Healthy with Cruciferous Vegetables
- Feeling Great with Cruciferous Vegetables

The word "brassica" translates in Latin as "cabbage," and this word is being used more and more by researchers to refer to the entire group of cruciferous vegetables. You'll find many plant scientists now using the Latin word *Brassicaceae* and the phrase " brassica vegetables" instead of Latin word *Cruciferae* and the traditional phrase "cruciferous vegetables" when referring to cabbage, kale, broccoli, collards and other foods in this vegetable subgroup.

Because cabbage's inner leaves are protected from the sunlight by the surrounding leaves, they are oftentimes lighter in color. There are three major types of cabbage: green, red, and Savoy. The color of green cabbage ranges from pale to dark green. Both green and red cabbage have smooth-textured leaves. Red cabbage has leaves that are either crimson or purple with white veins running through it. The leaves of Savoy cabbage are more ruffled and yellowish-green in color. Red and green cabbage have a more defined taste and crunchy texture as compared to Savoy cabbage's more delicate nature. Bok choy as well as Chinese (Napa) cabbage are other varieties of cabbage available. Bok choy has a mild flavor and a higher concentration of vitamin A. Chinese cabbage, with its pale green ruffled leaves, is great to use in salads. Red cabbage contains additional health benefits not found in green cabbage.

Sturdy, abundant, and inexpensive, cabbage is a longstanding dietary staple throughout the world and is so widely cultivated and stores so well that it is available throughout the year. However, it is at its best during the late fall and winter months when it is in season.

History

Cabbage has a long history of use both as a food and a medicine. It was developed from wild cabbage, a vegetable that was closer in appearance to collards and kale since it was composed of leaves that did not form a head.

It is thought that wild cabbage was brought to Europe around 600 B.C. by groups of Celtic wanderers. It was grown in Ancient Greek and Roman civilizations that held it in high regard as a general panacea capable of treating a host of health conditions.

While it's unclear when and where the headed cabbage that we know today was developed, cultivation of cabbage spread across northern Europe into Germany, Poland and Russia, where it became a very popular vegetable in local food cultures. The Italians are credited with developing the Savoy cabbage. Russia, Poland, China and Japan are a few of the leading producers of cabbage today.

Sauerkraut, a dish made from fermented cabbage, has a colorful legacy. Dutch sailors consumed it during extended exploration voyages to prevent scurvy. Early German settlers introduced cabbage and the traditional sauerkraut recipe were introduced into the United States. As a result of this affiliation, German soldiers, and people of German descent were often referred to as "krauts."

How to Select and Store

Choose cabbage heads that are firm and dense with shiny, crisp, colorful leaves free of cracks, bruises, and blemishes. Severe damage to the outer leaves is suggestive of worm damage or decay that may reside in the inner core as well.

There should be only a few outer loose leaves attached to the stem. If not, it may be an indication of undesirable texture and taste. Avoid buying precut cabbage, either halved or shredded, since once cabbage is cut, it begins to lose its valuable vitamin C content.

Put the whole head in a plastic bag in the crisper of your refrigerator. Loss of some nutrients in cabbage—for example, its vitamin C content—is likely to be slowed down through refrigeration. Red and green cabbage will keep if stored this way for about 2 weeks while Savoy cabbage will keep for about 1 week.

If you need to store a partial head of cabbage, cover it tightly with plastic wrap and refrigerate. Since the vitamin C content of cabbage starts to quickly degrade once it has been cut, you should use the remainder within a couple of days.

How to Enjoy

A Few Quick Serving Ideas

- Braise red cabbage with a chopped apple and red wine. This is a child-friendly dish since the alcohol (but not the flavor or the flavonoids) will evaporate.

- Combine shredded red and green cabbage with fresh lemon juice, olive oil, and seasonings such as turmeric, cumin, coriander, and black pepper to make coleslaw with an Indian twist.

Some WHFoods recipes that feature cabbage:

- Asian Chicken Salad
- Chinese Chicken Cabbage Salad
- Spicy Cabbage Soup
- Poached Fish with Napa Cabbage
- Sesame Braised Chicken & Cabbage
- Sweet N' Sour Cod with Cabbage and Broccoli
- Vegetarian Stir-Fry
- Napa Cabbage Salad
- 5-Minute Healthy Sautéed Red Cabbage
- Gingered Cabbage

Safety

Cabbage and Goitrogens

You may sometimes hear cabbage being described as a food that contains "goitrogens," or as a food that is "goitrogenic." For helpful information in this area—including our WHFoods Recommendations—please see our article What is meant by the term "goitrogen" and what is the connection between goitrogens, food, and health?.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Cabbage, red, cooked
1.00 cup
150.00 grams

Calories: 44
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin K	71.40 mcg	79	32.8	excellent
vitamin C	51.60 mg	69	28.5	excellent
vitamin B6	0.34 mg	20	8.3	excellent
manganese	0.33 mg	17	6.8	very good
fiber	3.90 g	16	6.5	very good
potassium	393.00 mg	11	4.6	very good
vitamin B1	0.11 mg	9	3.8	very good
folate	36.00 mcg	9	3.7	very good
copper	0.08 mg	9	3.7	very good
choline	32.10 mg	8	3.1	good
phosphorus	49.50 mg	7	2.9	good
vitamin B2	0.09 mg	7	2.9	good
magnesium	25.50 mg	6	2.6	good
calcium	63.00 mg	6	2.6	good
selenium	3.45 mcg	6	2.6	good
iron	0.99 mg	6	2.3	good

pantothenic acid	0.23 mg	5	1.9	good
protein	2.27 g	5	1.9	good
vitamin B3	0.57 mg	4	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Carrots

Although carrots are available throughout the year, locally grown carrots are in season in the summer and fall when they are the freshest and most flavorful. Carrots belong to the *Umbelliferae* family, named after the umbrella-like flower clusters that plants in this family produce. As such, carrots are related to parsnips, fennel, parsley, anise, caraway, cumin and dill. Carrots can be as small as two inches or as long as three feet, ranging in diameter from one-half of an inch to over two inches. Carrot roots have a crunchy texture and a sweet and minty aromatic taste, while the greens are fresh tasting and slightly bitter. While we usually associate carrots with the color orange, carrots can actually be found in a host of other colors including white, yellow, red, or purple. In fact, purple, yellow and red carrots were the only color varieties of carrots to be cultivated before the 15th or 16th century.

What's New and Beneficial about Carrots

- We are fortunate to have the results of a new 10-year study from the Netherlands about carrot intake and risk of cardiovascular disease (CVD)—and those results are fascinating. Intake of fruits and vegetables in the study was categorized by color and focused on four color categories: green, orange/yellow, red/purple, and white. Out of these four categories, orange/yellow (and in particular, foods with deeper shades of orange and yellow) emerged as most protective against CVD. And even more striking, carrots were determined to be the most prominent member of this dark orange/yellow food category. Participants who had the least carrot intake had the least amount of CVD risk reduction, even though they still received risk-reducing benefits from their carrot intake. However, participants who ate at least 25 more grams of carrots (with 25 grams being less than one-quarter of a cup) had a significantly lower risk of CVD. And the groups of participants who ate 50- or 75-grams more had an even more greatly reduced risk of CVD! We're not sure how any study could better demonstrate how easy it can be to lower disease risk by making a food like carrot part of the everyday diet in such achievable amounts.
- Much of the research on carrots has traditionally focused on carotenoids and their important antioxidant benefits. After all, carrots (along with pumpkin and spinach) rank high on the list of all commonly-consumed U.S. antioxidant vegetables in terms of their beta-carotene content. But recent research has turned the health spotlight onto another category of phytonutrients in carrots called polyacetylenes. In carrots, the most important polyacetylenes include falcarinol and falcarindiol. Several recent studies have identified these carrot polyacetylenes as phytonutrients that can help inhibit the growth of colon cancer cells, especially when these polyacetylenes are found in their reduced (versus oxidized) form. These new findings are exciting because they suggest a key interaction between the carotenoids and polyacetylenes in carrots. Apparently, the rich carotenoid content of carrots not only helps prevent oxidative damage inside our body, but it may also help prevent oxidative damage to the carrot polyacetylenes. In other words, these two amazing groups of phytonutrients in carrots may work together in a synergistic way to maximize our health benefits!
- Even people who usually boil carrots have discovered that they taste better steamed! In a recent study examining different methods for cooking vegetables, study participants were asked to evaluate the flavor and overall acceptability of the results. In comparison to boiling, participants in the study significantly favored the flavor and overall acceptability of steamed carrots to boiled carrots. This preference was also expressed by participants who had always boiled carrots in their previous kitchen practices.
- Not surprisingly, research on the carotenoids in carrots has become fairly sophisticated and we now know that it's especially important to protect one specific form of beta-carotene found in carrots called the (all-E)-beta-carotene isomer. That form of beta-carotene appears to have better bioavailability and antioxidant capacity than another beta-carotene form called the Z (cis) isomer form. With this new knowledge of beta-carotene specifics, researchers in Victoria, Australia wondered about the stability of (all-E)-beta-carotene under proper storage conditions. What they found was excellent retention of (all-E)-beta-carotene under the right storage conditions. Over several weeks period of time at refrigerator temperatures and with good humidity (as might be provided, for example by the wrapping of carrots in damp paper and placement in an air-tight container), there was very good retention of the carrots' (all-e)-beta-carotene. While we always like the idea of vegetable consumption in freshly-picked form, this finding is great news and gives all of us more flexibility for incorporating carrots into our diet.

Carrots, sliced, raw
1.00 cup
(122.00 grams)

Calories: 50
GI: low

Nutrient	DRI/DV
vitamin A	113%
biotin	20%
vitamin K	18%

fiber	14%
molybdenum	14%
potassium	11%
vitamin C	10%
vitamin B6	10%
manganese	9%
vitamin B3	8%
vitamin B1	7%
pantothenic acid	7%
copper	6%
phosphorus	6%
folate	6%
vitamin B2	5%
vitamin E	5%

Health Benefits

Carrots are perhaps best known for their rich supply of the antioxidant nutrient that was actually named for them: beta-carotene. However, these delicious root vegetables are the source not only of beta-carotene, but also of a wide variety of antioxidants and other health-supporting nutrients. The areas of antioxidant benefits, cardiovascular benefits, and anti-cancer benefits are the best-researched areas of health research with respect to dietary intake of carrots.

Antioxidant Benefits

All varieties of carrots contain valuable amounts of antioxidant nutrients. Included here are traditional antioxidants like vitamin C, as well as phytonutrient antioxidants like beta-carotene. The list of carrot phytonutrient antioxidants is by no means limited to beta-carotene, however. This list includes:

- Carotenoids
    - alpha-carotene
    - beta-carotene
    - lutein
- Hydroxycinnamic acids
    - caffeic acid
    - coumaric acid
    - ferulic acid
- Anthocyanindins
    - cyanidins
    - malvidins

Different varieties of carrots contain differing amounts of these antioxidant phytonutrients. Red and purple carrots, for example, are best known for the rich anthocyanin content. Oranges are particularly outstanding in terms of beta-carotene, which accounts for 65% of their total carotenoid content. In yellow carrots, 50% of the total carotenoids come from lutein. You're going to receive outstanding antioxidant benefits from each of these carrot varieties!

Cardiovascular Benefits

Given their antioxidant richness, it's not surprising to find numerous research studies documenting the cardiovascular benefits of carrots. Our cardiovascular system needs constant protection from antioxidant damage. This is particularly true of our arteries, which are responsible for carrying highly oxygenated blood.

A recent study from the Netherlands, in which participants were followed for a period of 10 years, has given us some fascinating new information about carrots and our risk of cardiovascular disease (CVD). In this study, intake of fruits and vegetables was categorized by color. The researchers focused on four color categories: green, orange/yellow, red/purple, and white. Out of these four categories, orange/yellow (and in particular, foods with deeper shades of orange and yellow) was determined to be the most protective against CVD. Within this dark orange/yellow food group, carrots were determined to be the single most risk-reducing food. Participants who had the least carrot intake had the least amount of CVD risk reduction, even though they still received risk-reducing benefits from their carrot intake. However, participants who ate at least 25 more grams of carrots (with 25 grams being less than one-quarter of a cup) had a significantly lower risk of CVD. And the groups of participants who ate 50- or 75-grams more had an even more greatly reduced risk of CVD! We're not sure how any study could better demonstrate how easy it can be to lower CVD risk by making a food like carrot part of the everyday diet.

Antioxidant nutrients in carrots are believed to explain many of the cardioprotective benefits provided by these root vegetables. The many different kinds of carrot antioxidants are most likely to work together and provide us with cardiovascular benefits that we could not obtain from any of these antioxidants alone if they were split apart and consumed individually, in isolation from each other. The synergistic effect of carrot antioxidants is a great example of a whole food and its uniqueness as a source of nourishment.

Yet in addition to the diverse mixture of carrot antioxidants, there is yet another category of carrot phytonutrient that is believed to help explain carrot protection against cardiovascular disease.That category is polyacetylenes. Polyacetylenes are unique phytonutrients made from metabolism of particular fatty acids (often involving crepenynic acid, stearolic acid and tariric acid). They are particularly common in the *Apiaceae/Umbelliferae* family of plants (which includes carrot). The two best-researched polyacetylenes in carrot are falcarinol and falcarindiol. Preliminary research on animals and in the lab has shown that carrot polyacetylenes have anti-inflammatory properties and anti-aggregatory properties (that help prevent excessive clumping together of red blood cells). So in addition to the unique mix of antioxidants in carrot, polyacetylenes may play a key role in the cardiovascular protection provided by this amazing food.

Vision Health

While you might expect to find a large number of human research studies documenting the benefits of carrot intake for eye health, there are relatively few studies in this area. Most studies about carotenoids and eye health have focused on carotenoid levels in the bloodstream and the activities of the carotenoids themselves, rather than the food origins of carotenoids (like carrots). Still, we have found some smaller scale human studies that show clear benefits of carrot intake for eye health. For example, researchers at the Jules Stein Institute at the University of California at Los Angeles determined that women who consume carrots at least twice per week - in comparison to women who consume carrots less than once per week - have significantly lower rates of glaucoma (damage to the optic nerve often associated with excessive pressure inside the eye). Intake of geranyl acetate - one of the photonutrients that is present in carrot seeds (and sometimes extracted from purified carrot seed oil) has also been repeatedly associated with reduced risk of cataracts in animal studies. However, researchers have yet to analyze the amount of geranyl acetate in the root portion of the carrot and the impact of dietary intake on risk of cataracts.

Anti-Cancer Benefits

The anti-cancer benefits of carrot have been best researched in the area of colon cancer. Some of this research has involved actual intake of carrot juice by human participants, and other research has involved the study of human cancer cells types in the lab. While much more research is needed in this area, the study results to date have been encouraging. Lab studies have shown the ability of carrot extracts to inhibit the grown of colon cancer cells, and the polyacetylenes found in carrot (especially falcarinol) have been specifically linked to this inhibitory effect. In studies of carrot juice intake, small but significant effects on colon cell health have been shown for participants who consumed about 1.5 cups of fresh carrot juice per day.

We're confident that future studies in this area will show carrot intake as being protective against risk of colon cancer. Carrots are simply too rich in digestive tract-supporting fiber, antioxidant nutrients, and unique phytonutrients like falcarinol to be neutral when it comes to support of the lower digestive tract and colon cancer protection.

Description

As one of the most popular root vegetables in the U.S. - and widely enjoyed in many other countries as well - carrots almost feel like an old friend for many people who are looking for just the right crunchy snack or addition to a salad. We've even seen one study of 8-11 year-old children in France who were given pictures of 54 vegetables and were mostly likely to pick out carrots (along with lettuce and tomatoes) as easily identifiable and likeable vegetables. In the U.S., there seems to be an equal liking for carrots at the other end of the age spectrum as well. Individuals 76 years of age and older eat twice as many carrots as individuals under 40, with the overall average being about 1 cup of carrots per week.

It's easiest to identify carrots as belonging to the *Umbelliferae* family of plants, since their leafy greens form an umbrella-like cluster at the top of the root. However, this same family of plants is also commonly known as the *Apiaceae* family. While the International Code of Botanical Nomenclature accepts both designations, the use of *Apiaceae* is becoming more and more common in carrot research. This same botanical family includes parsley, anise, celery, parsnips, fennel, caraway, cumin and dill.

The name "carrot" comes from the Greek word "karoton," whose first three letters (kar) are used to designate anything with a horn-like shape. (That horn-like shape, of course, refers to the taproot of the carrot that is the plant part we're most accustomed to consuming in the U.S.). The beta-carotene that is found in carrots was actually named for the carrot itself!

Even though U.S. consumers are most familiar with carrots as root vegetables bright orange in color, an amazing variety of colors are found worldwide for this vegetable. (All of these color varieties, however, still belong to the same genus and species of plant, *Daucus carota*.) Here is a short list of some of the more popular carrot varieties, categorized by color:

- Orange Carrots
    - Scarlet Nantes (especially valued for its sweetness)
    - Danvers (often raised for processing)
    - Camden (often raised for processing)
    - Other popular varieties include Navajo, Sirkana, Top Cut and Inca
- Purples Carrots
    - Indigo
    - Maroon
    - Purple Dragon
    - Cosmic Purple
    - Purple Haze
- Yellow Carrots
    - Sunlite
    - Solar Yellow
    - Yellowstone
- White Carrots
    - Creme De Lite
    - White Satin
- Red Carrots
    - Supreme Chateney
    - Red Samurai

History

The carrot can trace its ancestry back thousands of years, originally having been cultivated in central Asian and Middle Eastern countries, along with parts of Europe. These original carrots looked different from those that we are accustomed to today, featuring red, purple, and yellow coloring rather than the bright orange that we've become accustomed to in U.S. supermarkets. Carrots became widely cultivated in Europe during the 15th and 16th centuries and were first brought over to North America during this same general time period.

In today's commercial marketplace, China currently produces about one-third of all carrots bought and sold worldwide. Russia is the second largest carrot producer, with the U.S. following a close third. Many European countries produce substantial amounts of carrots (over 400,000 metric tons) and Turkey, Mexico, India, Indonesia, Australia and Canada are also important countries in the worldwide production of carrots. Within the U.S., about 12,000 acres of carrots for processing are planted each year, resulting in about 320,000 tons of carrots. Over 80% of all fresh market carrot production in the U.S. comes from California, with Michigan and Texas emerging as the next two largest fresh production states.

Currently,U.S. adults average about 12 pounds of carrot intake each year. Approximately 9 pounds are being consumed in fresh form, with the other 3 pounds are being consumed in frozen or canned products. This amount translates into approximately 1 cup of carrots each week in fresh, frozen, or canned form.

How to Select and Store

Carrot roots should be firm, smooth, relatively straight and bright in color. The deeper the orange-color, the more beta-carotene is present in the carrot. Avoid carrots that are excessively cracked or forked as well as those that are limp or rubbery. In addition, if the carrots do not have their tops attached, look at the stem end and ensure that it is not darkly colored as this is also a sign of age. If the green tops are attached, they should be brightly colored, feathery and not wilted. Since the sugars are concentrated in the carrots' core, generally those with larger diameters will have a larger core and therefore be sweeter.

Carrots are hardy vegetables that will keep longer than many others if stored properly. The trick to preserving the freshness of carrot roots is to minimize the amount of moisture they lose. To do this, make sure to store them in the coolest part of the refrigerator in a plastic bag or wrapped in a paper towel, which will reduce the amount of condensation that is able to form. Loss of some nutrients in carrots—for example, its vitamin C content—is likely to be slowed down through refrigeration.

They should be able to keep fresh for about two weeks. Research has shown that the especially valuable (all-E)-beta-carotene isomer is well-retained in carrots if stored properly. Carrots should also be stored away from apples, pears, potatoes and other fruits and vegetables that produce ethylene gas since it will cause them to become bitter.

If you purchase carrot roots with attached green tops, the tops should be cut off before storing in the refrigerator since they will cause the carrots to wilt prematurely as they pull moisture from the roots. While the tops can be stored in the refrigerator, kept moist by being wrapped in a damp paper, they should really be used soon after purchase since they are fragile and will quickly begin to wilt.

How to Enjoy

A Few Quick Serving Ideas

- Shredded raw carrots and chopped carrot greens make great additions to salads.
- Combine shredded carrots, beets and apples, and eat as a salad.
- For quick, nutritious soup that can be served hot or cold, purée boiled carrots and potatoes in a blender or food processor, and add herbs and spices to taste.
- Spiced carrot sticks are a flavorful variation on an old favorite at parties or at the dinner table. Soak carrot sticks in hot water spiced with cayenne, coriander seeds and salt. Allow to cool, drain and serve.

WHFoods Recipes That Include Carrots

- Asian Chicken Salad
- Barley Mushroom Soup
- Carrot Coconut Soup
- Minestrone Surprise
- Red Kidney Bean Soup with Lime Yogurt
- Super Energy Kale Soup
- 15-Minute Seared Tuna with Sage
- Poached Halibut with Fennel and Cauliflower
- Holiday Turkey with Rice Stuffing & Gravy with Fresh Herbs
- Asian-Flavored Broccoli with Tofu
- Braised Kidney Beans & Sweet Potato
- Curried Lentils
- Miso Stir-Fry
- Moroccan Eggplant with Garbanzo Beans
- Primavera Verde
- Great Antipasto Salad
- Super Carrot Raisin Salad
- Carrot Cashew Paté
- Carrots with Honey Mustard Sauce
- Garlic Dip with Crudites
- Minted Carrots with Pumpkin Seeds
- Minted Green Peas & Carrots
- Steamed Vegetable Medley

Safety

Carrots and Carotoderma

Excessive consumption of carotene-rich foods may lead to a condition called *carotoderma* in which the palms or other skin develops a yellow or orange cast. This yellowing of the skin is presumably related to *carotenemia*, excessive levels of carotene in the blood. The health impact of carotenemia is not well researched. Eating or juicing high amounts of foods rich in carotene, like carrots, may over tax the body's ability to convert these foods to vitamin A. The body slowly converts carotene to vitamin

A, and extra carotene is stored, usually in the palms, soles or behind the ears. If the cause of the carotenemia is eating excessively high amounts of foods like carrots, the condition will usually disappear after reducing consumption.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Carrots, sliced, raw
1.00 cup
122.00 grams

Calories: 50
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin A	1019.07 mcg RAE	113	40.7	excellent
biotin	6.10 mcg	20	7.3	very good
vitamin K	16.10 mcg	18	6.4	very good
fiber	3.42 g	14	4.9	very good
molybdenum	6.10 mcg	14	4.9	very good
potassium	390.40 mg	11	4.0	very good
vitamin B6	0.17 mg	10	3.6	very good
vitamin C	7.20 mg	10	3.5	very good
manganese	0.17 mg	9	3.1	good
vitamin B3	1.20 mg	8	2.7	good
vitamin B1	0.08 mg	7	2.4	good
pantothenic acid	0.33 mg	7	2.4	good
phosphorus	42.70 mg	6	2.2	good
folate	23.18 mcg	6	2.1	good
copper	0.05 mg	6	2.0	good
vitamin E	0.81 mg (ATE)	5	1.9	good
vitamin B2	0.07 mg	5	1.9	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Cauliflower

What's New and Beneficial About Cauliflower

- Information gathered for a large-scale study called the European Prospective Investigation into Cancer and Nutrition (EPIC) has shown cauliflower to be an especially popular cruciferous vegetable in 10 western European countries, tying for first place with cabbage for the vegetable consumed most frequently. Here is how cauliflower stacked up against other cruciferous vegetables as a percentage of all vegetables eaten: e cauliflower (25%); white cabbage (13%), and cabbage "unspecified" (12%). It is also interesting to compare cauliflower with broccoli in the study findings since cauliflower accounted for a greater percentage of total vegetable consumption than broccoli (18%).
- Recent studies have shown that boiling, full submersion of cauliflower in water when cooking, is not the best cooking practice if you want to preserve key phytonutrients in this cruciferous vegetable. In one study, 3 minutes of cauliflower submersion in a full pot of boiling water was enough to draw out more phytonutrients than 10 full minutes of steaming. Glucosinolates and flavonoids were the phytonutrients lost from cauliflower in greater amounts with full water submersion.
- At least in some countries, cooked cauliflower is greatly preferred over raw cauliflower. The European Prospective Investigation into Cancer and Nutrition (EPIC)—also referred to above—has found that 80% of the cauliflower consumed in 10 European countries (including France, Italy, Spain, Germany, Greece, the Netherlands, Norway, Sweden and Denmark) is enjoyed in cooked form (versus raw).
- Several recent studies have shown the cooking of raw cauliflower to significantly improve its ability to bind together with bile acids. Since bile acid binding is a well-documented method for helping regulate blood cholesterol levels, these studies point to potential cardiovascular benefits from consumption of cooked cauliflower. The most detailed study that we have seen in this area examined cauliflower that had been steamed for 10 minutes.

WHFoods Recommendations

You'll want to include cauliflower as one of the cruciferous vegetables you eat on a regular basis if you want to receive the fantastic health benefits provided by the cruciferous vegetable family. At a minimum, we recommend 3/4 cup of cruciferous vegetables on a daily basis. This amount is equivalent to approximately 5 cups per week. A more optimal intake amount would be 1-1/2 cups per day, or about 10 cups per week. You can use our Veggie Advisor for help in figuring out your best cruciferous vegetable options.

As with all vegetables, be sure not to overcook cauliflower. We suggest Healthy Sautéeing cauliflower rather than the more traditional methods of boiling or steaming, which makes them waterlogged, mushy and lose much of its flavor. Cut cauliflower florets into quarters and let sit for 5 minutes before cooking. For great tasting cauliflower add 1 teaspoon of turmeric when adding the cauliflower to the skillet.

Cauliflower, cooked
1.00 cup
(124.00 grams)

Calories: 29
GI: very low

Nutrient	DRI/DV
vitamin C	73%
vitamin K	19%
folate	14%
pantothenic acid	13%
vitamin B6	12%
choline	11%
fiber	11%
omega-3 fats	9%
manganese	8%
phosphorus	6%
biotin	5%
potassium	5%
vitamin B2	5%
protein	5%
vitamin B1	4%
magnesium	3%

vitamin B3	3%

Health Benefits

Perhaps because the most commonly consumed varieties of cauliflower are white, many people may not associate cauliflower with the same nutrient richness as its fellow green cruciferous vegetables like broccoli or kale. This perspective on cauliflower does not match up with the research findings on this amazing food. White varieties of cauliflower are just as rich in phytonutrients as green cruciferous vegetables, and this nutrient richness is exemplified by its glucosinolates, described below.

Glucosinolates in Cauliflower

The phytonutrients provided by cauliflower are headed off by its glucosinolates. These sulfur-containing compounds are well-studied and known to provide a variety of health benefits. The glucosinolates best-studied in cauliflower include:

- glucobrassicin
- glucoiberin
- glucoerucin
- glucoraphanin
- neo-glucobrassicin
- progoitrin
- sinigrin
- 4-hydroxyglucobrassicin
- 4-methoxyglucobrassicin

Glucosinolates are the subject of increasing health research, and the more that is learned about glucosinolates, the broader scientists see their role in supporting our body systems. The list of body systems supported by intake of glucosinolates from cauliflower and other cruciferous vegetables has now come to include our cardiovascular, digestive, immune, inflammatory, and detoxification systems. For in-depth information about glucosinolates and health support, see our article Feeling Great with Cruciferous Vegetables.

Antioxidants in Cauliflower

Beta-carotene, beta-cryptoxanthin, caffeic acid, cinnamic acid, ferulic acid, quercetin, rutin, and kaempferol are among cauliflower's key antioxidant phytonutrients. An emphatic addition to this list would be vitamin C, since cauliflower is our 10th best source of vitamin C among all 100 WHFoods. Like most of its fellow cruciferous vegetables, cauliflower is also a very good source of manganese—a mineral antioxidant that is especially important in oxygen-related metabolism.

Recent research has begun to investigate the relationship between cauliflower's overall antioxidant capacity and its sulfur-containing glucosinolates. The glucosinolates in cauliflower appear to have an important relationship with its antioxidant capacity, although scientists are not yet sure about the exact role that glucosinolates play in this regard.

A final note about cauliflower antioxidants: the Graffiti variety of purple cauliflower has been the subject of several recent research studies and has been shown to have especially strong antioxidant capacity due to its rich concentration of anthocyanins. If you decide to incorporate purple cauliflower into your meal plan, we recommend that you be extra careful to avoid overcooking. Research studies on anthocyanins in cauliflower have shown that the greatest proportion of these antioxidant pigments is found in the outermost layers of the cauliflower head and this location makes them especially susceptible to loss from overcooking.

Cauliflower and Risk of Specific Health Conditions

Intake of cauliflower has been analyzed in relationship to a variety of different disease risks. When consumed at least once per week, cauliflower has been associated with decreased risk of colorectal cancer and has been shown to be associated with a greater decrease of risk than broccoli (when consumed in a comparable amount). In terms of prostate cancer risk, cauliflower and broccoli have shown a similar ability to decrease risk. While we have not seen individual studies focused exclusively on the relationship between cauliflower and cardiovascular diseases, cauliflower has been included along with other cruciferous vegetables (most commonly broccoli and cabbage) in studies on cardiovascular diseases and has been repeatedly associated with decrease risk. Because of its ability to bind bile acids, intake of cooked cauliflower has also been linked to better regulation of blood cholesterol. In one study focusing on intake of broccoli, cabbage, cauliflower, and Brussels sprouts in middle-aged women, incidence of obesity was reduced when women in the study increased their servings over time by about 3 servings per day.

Nutritional Benefits From Raw Versus Cooked Cauliflower

Studies show strong nutrient richness in both raw and cooked cauliflower. We've been impressed by study results not only in areas involving conventional nutrients like vitamin C but also in areas involving phytonutrients like sulfur-containing compounds and flavonoids. Although there can be loss of water-soluble nutrients during cooking with water or other liquids, there can also be increased bioavailability from the freeing up of nutrients that remained inside the cells in raw cauliflower but got released from those cells during cooking due to the breakdown of cell walls. For example, we've seen studies showing increased bioavailability of the carotenoids lutein and zeaxanthin following the cooking of cauliflower. Of course, since the chewing of raw cauliflower could also serve to break down cell walls and make carotenoids more bioavailable, what we end up with here is a "win-win" situation in which both raw and cooked cauliflower can make great nutrient contributions to our health.

This same "win-win" situation appears to hold true for cauliflower's sulfur-containing compounds. For example, studies have shown that levels of sinigrin—one of the best-studied glucosinolates in cauliflower—decrease as a result of both steaming and boiling. However, alongside of this decrease in sinigrin is significantly improved bioavailability of the sinigrin that still remains inside the cooked cauliflower.

One final note on temperature and the health benefits of cauliflower. A recent study on the freezing of cauliflower has shown its nutrients to be fairly stable after one-year freezer storage. Cauliflower in the study was blanched in near-boiling water for three minutes prior to freezing for one year. Numerous phytonutrients were evaluated in the study, including cauliflower's sulfur-containing compounds. While nutrients levels were typically reduced after this year of freezer storage, loss of nutrients typically averaged about 15-35%. Although we strongly support purchase of fresh vegetables—including cauliflower—whenever possible, frozen cauliflower may make a second-best option in some meal plans.

Description

While many people recognize cauliflower as a member of the cruciferous vegetable family, this popular plant is more closely connected with its fellow "crucifers" than people might realize. Cauliflower, cabbage, collard greens, kale, Brussels sprouts, and broccoli all belong to the same genus and species of plant (*Brassica oleracea*) and this degree of commonality among popular plant foods is somewhat usual. While the traditional family name for this group of foods is "cruciferous vegetables," many scientists are tending away from the science name *Cruciferae* for this plant family and more toward the name *Brassicaceae*. So you will also hear cauliflower being referred to as not only a "cruciferous" vegetable but a "brassica" vegetable as well. (In Latin, the word "*brassica*" means "cabbage.")

In the U.S., most cauliflower varieties have been selected for their formation of a fairly large compact head (which is also called the "curd"). The cauliflower head is actually a closely packed arrangement of undeveloped flower buds. Surrounding the curd are ribbed, coarse green leaves that help shield this part of the plant from sunlight. This shielding of the cauliflower head also discourages the development of chlorophyll in the head and is one of the reasons that this portion of the plant is typically not bright green in color. (That being said, there are green varieties of cauliflower available in the marketplace.) The raw cauliflower head tends to be firm but slightly spongy in texture and can have a slightly sulfur-like flavor, which some people also describe as faintly bitter. However, it is also common for people to describe the cauliflower flavor as nutty and slightly sweet.

Cauliflower and broccoli are so closely related that some naturally occurring varieties of cauliflower are often referred to by both names. Romanesco cauliflower—also called romanesco broccoli—is a perfect example. This variety of *Brassica oleracea* has a flavor somewhere in between cauliflower and broccoli and a highly distinct appearance in which the compact cauliflower head rises upward in a tree-like or pyramidal shape. Romanesco cauliflower is also sometimes referred to as broccoflower, but this name is more commonly used to refer to yet different cultivars of cauliflower with a green head (or curd). As you can see, it is sometimes difficult to clearly differentiate between cauliflower and broccoli due to the strong biological overlap between these foods. It's also interesting to note that in most market analyses of broccoli imports and exports, the two foods are grouped together into a single category.

Types of Cauliflower

Color can be a very practical way of separating different varieties of cauliflower into basic types. The chart below shows basic color groupings for cauliflower and specific varieties that belong to each group.

White	Green	Purple	Orange
Snow Cloud	Emeraude	Graffiti	Cheddar
Snowball	Vitaverde	Violetta	Orange Burst
Cloud	Green Macerata	Purple of Sicily	Sunset
Aviso	Monte Verde	Mulberry	

History

Cauliflower is generally thought to be native to the general Mediterranean region, especially the northeastern portion of this region in what is now the country of Turkey. Its history here dates back over 2,000 years. It's interesting to note that varieties of cauliflower were not always selected to include a large, compact head (or "curd") and that in many regions of the world, cauliflower crops still do not focus on those varieties. "Loose curd" cauliflower, for example, is widely enjoyed in many areas of China. Roughly speaking, "loose curd" cauliflower can be considered as comparable to broccoli raab—a form of broccoli that also lacks a large compact head and features longer stems and leaves.

Among cruciferous vegetables in general, cauliflower is not nearly as popular in the U.S. as in other parts of the world. While the U.S. is the world's largest producer of broccoli, when it comes to cauliflower, it is not remotely close to China or India, which produce 74% of the world's cauliflower. Given the remarkable nutritional benefits of cauliflower, we hope that this pattern will change over time and the cauliflower will become a more widely enjoyed cruciferous vegetable.

How to Select and Store

When purchasing cauliflower, look for a clean, creamy white, compact curd in which the bud clusters are not separated. Spotted or dull-colored cauliflower should be avoided, as well as those in which small flowers appear.

Heads that are surrounded by many thick green leaves are better protected and will be fresher. As its size is not related to its quality, choose one that best suits your needs.

Store uncooked cauliflower in a paper or plastic bag in the refrigerator where it will keep for up to a week. To prevent moisture from developing in the floret clusters, store it with the stem side down. Loss of some nutrients in cauliflower—for example, its vitamin C content—is likely to be slowed down through refrigeration.

If you purchase pre-cut cauliflower florets, consume them within one or two days as they will lose their freshness after that. Since cooking causes cauliflower to spoil quicker, consume it within two to three days of placing in the refrigerator after cooking.

How to Enjoy

A Few Quick Serving Ideas

Puree cooked cauliflower, add fennel seeds and your other favorite herbs and spices and serve as soup.

Because of its shape and taste, cauliflower florets make wonderful crudite for dipping in sauces.

WHFoods Recipes That Feature Cauliflower

- Poached Halibut with Fennel and Cauliflower
- 5-Minute Healthy Sautéed Cauliflower
- Asian Sauteed Cauliflower

Safety

Cauliflower and Goitrogens

You may sometimes hear cauliflower being described as a food that contains "goitrogens," or as a food that is "goitrogenic." For helpful information in this area—including our WHFoods Recommendations—please see our article What is meant by the term "goitrogen" and what is the connection between goitrogens, food, and health?.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Cauliflower, cooked **1.00 cup** **124.00 grams**				**Calories: 29** **GI: very low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin C	54.93 mg	73	46.2	excellent
vitamin K	17.11 mcg	19	12.0	excellent
folate	54.56 mcg	14	8.6	excellent
pantothenic acid	0.63 mg	13	8.0	excellent
vitamin B6	0.21 mg	12	7.8	excellent
choline	48.48 mg	11	7.2	very good
fiber	2.68 g	11	6.8	very good
omega-3 fats	0.21 g	9	5.5	very good
manganese	0.16 mg	8	5.0	very good
phosphorus	39.68 mg	6	3.6	very good
biotin	1.61 mcg	5	3.4	very good
potassium	176.08 mg	5	3.2	good
vitamin B2	0.06 mg	5	2.9	good
protein	2.28 g	5	2.9	good
vitamin B1	0.05 mg	4	2.6	good
vitamin B3	0.51 mg	3	2.0	good
magnesium	11.16 mg	3	1.8	good

World's Healthiest Foods Rating	**Rule**
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Celery

What's New and Beneficial About Celery

- If you have become accustomed to thinking about celery as a crunchy, low-cal vegetable but not a key part of your health support, it is time to think again. Recent research has greatly bolstered our knowledge about celery's anti-inflammatory health benefits, including its protection against inflammation in the digestive tract itself. Some of the unique non-starch polysaccharides in celery—including apiuman—appear especially important in producing these anti-inflammatory benefits. (Unlike starchy polysaccharides that provide plants with a way to store simple sugars, these non-starch polysaccharides in celery help provide this vegetable with its unique structure and are not made from simple sugars but rather from pectins.)
- In addition to well-known antioxidants like vitamin C and flavonoids, scientists have now identified at least a dozen other types of antioxidant nutrients in celery. These antioxidants include dihydrostilbenoids like lunularin as well as furanocoumarins like bergapten and psoralen. The antioxidant support we get from celery is largely due to its phenolic nutrients that have been shown to help protect us against unwanted oxidative damage to our cells, blood vessels, and organ systems
- If you are planning to steam vegetables as part of your meal, you can include celery without having to worry about excessive loss of its phenol-based antioxidants. In a recent study, researchers compared the impact of steaming (10 minutes) versus boiling (10 minutes) versus blanching (3 minute submersion in boiling water) on the total phenolic antioxidant nutrients in celery. Both boiling and blanching resulted in substantial loss of these antioxidants, in the range of 38-41%. With steaming, however, 83-99% of these antioxidants were retained in the celery even after 10 minutes. While we encourage the practice of steaming as a cooking method of choice for many of our WHFoods vegetables, it's great to see how nutrient-preserving steaming can be in the case of celery.
- Based on multiple recent studies involving nutrient changes in stored, refrigerated celery, we recommend a period of 5-7 days as a window of time for consuming fresh celery. While some nutrients appear to be stable in whole, refrigerated celery for longer periods of time, several studies show greater losses of phenolic antioxidants in celery after this week-long period. In addition, based on changes in flavonoid content, we also recommend that you wait to chop up your celery just before you are adding it to a salad or cooked dish (rather than chopping it up the night before and leaving it stored in the refrigerator overnight). This will help to preserve its maximum nutrient potential.

Celery, diced, raw
1.00 cup
(101.00 grams)

Calories: 16
GI: very low

Nutrient	DRI/DV
vitamin K	33%
molybdenum	11%
folate	9%
potassium	8%
fiber	6%
manganese	5%
vitamin B2	5%
pantothenic acid	5%
copper	4%
calcium	4%
vitamin C	4%
vitamin B6	4%
phosphorus	3%
magnesium	3%
vitamin A	3%

Health Benefits

Antioxidant and Anti-Inflammatory Support

Celery is an important food source of conventional antioxidant nutrients, including vitamin C, beta-carotene, and manganese. But its "claim to fame" in terms of antioxidant nutrients may very well be its phytonutrients. Many of these phytonutrients fall into the category of phenolic antioxidants and have been shown to provide anti-inflammatory benefits as well. Below is a representative list of the phenolic antioxidants found in celery.

- Phenolic acids
    - caffeic acid
    - caffeolyquinic acid
    - cinnamic acid
    - coumaric acid
    - ferulic acid
- Flavones
    - apigenin
    - luteolin
- Flavonols
    - quercetin
    - kaempferol
- Dihydrostilbenoids
    - lunularin
- Phytosterols
    - beta-sitosterol
- Furanocoumarins
    - bergapten
    - psoralen

In animal studies, celery extracts containing the above-listed phytonutrients have been shown to decrease risk of oxidative damage to body fats and risk of oxidative damage to blood vessel walls. In addition, these celery extracts have been shown to prevent inflammatory reactions in the digestive tract and blood vessels. Interestingly, there is also some animal research showing the ability of celery extracts to help protect the digestive tract and liver following consumption of acrylamides. (Acrylamides are potentially toxic substances formed in food through a reaction of sugars and amino acids, usually through the process of frying.)

While most of the research above involves animals versus humans, we have also seen studies showing the importance of celery in diets that are considered to be high in antioxidant and anti-inflammatory health benefits. For example, we've seen one recent study showing celery to provide 7% of all flavonol and flavone antioxidants in the diet of adults in China. In addition, mechanisms of anti-inflammatory support have also been shown in human studies. For example, we've seen research showing the ability of celery juice and celery extracts to lower the activity of tumor necrosis factor alpha (TNF-alpha), as well as the activity of nuclear factor kappa B (NF-kB). Decreased levels of the pro-inflammatory cytokines interleukin 1B (IL-1B) and interleukin 8 (IL-8) have also been seen in these studies. All of these four messaging molecules play a key role in the body's inflammatory responses, and keeping them in check is an important step in the prevention of unwanted inflammation.

One interesting aspect of celery's antioxidant phytonutrients involves its furanocoumarins. Prior to harvest - when celery is still growing in the ground - it responds to stress by producing furanocoumarins in greater amounts. These substances help protect it in its natural living conditions. Even after celery has been harvested, however, and you start to chop it up on your kitchen countertop, it will still increase its production of furanocoumarins, and you will get greater amounts of these phytonutrients for this reason. (However, it is incorrect to assume that the chopping of celery makes it nutritionally "better" than it was before you chopped it. That's because other phytonutrients decrease simultaneously with the increase in furanocoumarins. The net result is basically a change in the composition of the celery phytonutrients, an interesting topic about which we hope to see more research on in the future.)

Digestive Tract Support

In addition to its antioxidant and anti-inflammatory nutrients that help protect the digestive tract as a whole, celery contains pectin-based polysaccharides that can provide the stomach with special benefits. We've become accustomed to thinking about polysaccharides as starchy molecules that are used by cells as a way to store up simple sugars. But there are other types of polysaccharides in plants, including the non-starch, pectin-based polysaccharides found in celery. (Pectin is a sugar-related molecule that is largely formed from a substance called glucuronic acid.) The pectin-based polysaccharides found in celery — including apiuman—appear to have special importance in producing anti-inflammatory benefits. In animal studies, celery extracts containing apiuman have been shown to improve the integrity of the stomach lining, decrease risk of stomach ulcer (gastric ulcer), and better control the levels of stomach secretions. We look forward to future research that may confirm these stomach support benefits in humans based on dietary intake of celery in its whole food form.

Cardiovascular Support

Given the antioxidant and anti-inflammatory properties of celery described earlier in this section, it's not surprising to see the interest of researchers in the cardiovascular benefits of celery. Oxidative stress and inflammation in the bloodstream are critical problems in the development of many cardiovascular diseases, especially atherosclerosis. Unfortunately, most of the studies we've seen in this area have involved animals. Still, we've seen promising connections between the pectin-based polysaccharides in celery and decreased risk of inflammation in the cardiovascular system. We've seen these same types of connections between celery flavonoids and decreased risk of cardiovascular inflammation.

Phthalides are a further category of phytonutrients found in celery that seems important to mention as providing potential cardiovascular benefits. Phenolic substances found in celery, phthalides are a major contributor to the unique flavor of this vegetable. (Sedanenolide and butylphthalides are examples of phthalides found in celery.) Researchers have demonstrated that celery phthalides can act as smooth muscle relaxants, most likely through their impact on the flow of calcium and potassium inside cells and related nervous system activity involved with muscle relaxation. Of course, relaxation of smooth muscles surrounding our blood vessels allows them to expand and the result is a lowering of our blood pressure. (This overall process is called vasodilation.)

Phthalides in celery may also act as diuretics, further helping to lower the pressure inside our blood vessels. Unfortunately, most of the research we've seen in this area involves celery seeds, celery oil, or celery extracts - not the whole food itself. So it's not yet clear if these muscle-relaxant properties and blood pressure-lowering properties of celery phthalides will be provided to us if we include celery in our meal plans in everyday food amounts. But we will be surprised if future research on dietary intake of celery does not show some type of cardiovascular benefit directly related to celery phthalides.

Other Health Benefits

Because chronic oxidative stress and excessive inflammation are key risk factors for the development of many cancer types, it's not surprising to see scientists interested in the potential benefits of celery intake for cancer prevention. While we've seen speculation about celery benefits for stomach cancer, colon cancer, and bladder cancer, we've been unable to find actual human research studies in any of these areas. Hopefully, future research studies will address the potential cancer-related benefits of celery much more closely.

Description

In most U.S. markets, it's the Pascal family of greenish to pale-green celery cultivars that we've become most accustomed to finding in the produce section. Pascal celery is larger than most other celery types, with firm, solid stalks and leafy ends. Yet even within this particular scientific type of celery (*Apium graveolens var. dulce*), there are many other options including Matador, Red Stalk, Tango, and Sonora. Celery actually comes in a variety of colors from sheer white to vibrant gold to rich red and deep green.

In this genus/species of plant (*Apium graveolens*) are also found two other important types of celery. The first is celeriac (also called root celery, turnip-root celery, or knob celery). Just like the name suggests, root celery is characterized by a large root ball, which is especially prized for its unique somewhat nut-like taste. (The scientific name for celeriac is *Apium graveolens var. rapaceum*.) The second type of celery is leafy celery (*Apium graveolens var. secalinum*), which looks very similar to parsley but tastes like celery! Root and leaf celeries are valued worldwide for their unique flavors and aromas; they are often "main plate" vegetables rather than salad or soup additions.

Regardless of which celery variety you choose to buy or grow, there are nutrient benefits to be found in all parts of the plant, including the leaves, stalks, roots, and seeds. "Celery hearts" usually refers to the innermost stalks of Pascal celery. These stalks are typically the most tender.

The bigger family of plants that houses celery is what scientists call the *Apiaceae* or *Umbelliferae* family. It is also commonly known as the parsley or carrot family. (Just compare leafy carrot tops or parsley leaves with celery leaves and you'll see why.) In addition to celery, carrots, and parsley, this plant family also includes dill, fennel, cilantro/coriander, parsnip, anise, caraway, chervil, cumin, angelica, and asafetida.

History

Over time, many different types of plants across the world have been referred to by the common name "wild celery." Most of these plants—although not all of them—belong to the same family (*Apiaceae/Umbellerifereae*) as the Pascal celery found in

U.S. markets. You'll find Australian celery, Vietnamese celery, Indian celery, Maori celery, and water celery all being referred to as "wild celery" in various cultures.

The direct ancestors of Pascal celery were cultivated in parts of Europe and the Mediterranean as early as 1000 BC, and we have evidence of celery being used as a medicinal plant in ancient Egypt. There's also evidence that ancient Greek athletes were awarded celery leaves to commemorate their winning.

Today over 1 billion pounds of celery are produced each year in the United States, with California, Michigan and Florida accounting for about 80% of all celery production. The average U.S. adult eats about 6 pounds of celery per year. A substantial amount of celery in the U.S. comes from Mexico, and the U.S. exports about 200 million pounds of celery to Canada each year.

On a worldwide basis, celery is often served as a "major plate vegetable" rather than an additive to salads or soups. In addition, root celery varieties of this food (chosen for their large root balls rather then their stalks) are often cultivated over the large stalk Pascal varieties that have become most popular in the U.S.

How to Select and Store

Choose celery that looks crisp and snaps easily when pulled apart. It should be relatively tight and compact and not have stalks that splay out. The leaves should be pale to bright green in color and free from yellow or brown patches. Sometimes celery can have a condition called "blackheart" that is caused by insects. To check for damage, separate the stalks and look for brown or black discoloration. In addition, evaluate the celery to ensure that it does not have a seed stem, the presence of a round stem in the place of the smaller tender stalks that should reside in the center of the celery. Celery with seed stems are often more bitter in flavor.

Most people use plastic produce bags to bring celery (and other fresh vegetables) home from the market. If this method is the one you use, you can leave your celery in the plastic produce bag, squeeze out any extra air, and close the bag securely for storage in your refrigerator. While food storage in plastic bags can create health risks under certain circumstances, 5-7 days of refrigerator storage for an uncut head of celery is not one of them. The refrigerator temperature is too cold (about 40°F/4°C), the time period too short, and the celery-to-plastic surface contact too moderate to create a substantial health risk from this use of a plastic produce bag. If possible, please recycle the plastic bag after using.

We recommend a period of 5-7 days as a window of time for refrigeration of fresh celery. While some nutrients appear to be stable in whole, refrigerated celery for longer periods of time, several studies show greater losses of phenolic antioxidants in celery after this week-long period. In addition, based on changes in flavonoid content, we also recommend that you wait to chop up your celery just before you are adding it to a salad or cooked dish (rather than chopping it up the night before and leaving it stored in the refrigerator overnight). If you find yourself needing to cut up celery far ahead of time, in a way that requires overnight storage in your refrigerator, we recommend that you place the cut celery into a hard plastic or glass container instead of a soft plastic bag. Since the cutting of celery will expose more of its surface area, you can avoid increased contact of more celery surfaces to the less stable materials that are found in soft plastic bags by using more sturdy containers for your cut celery. Loss of some nutrients in celery—for example, its vitamin C content—is likely to be slowed down through refrigeration.

Freezing will make celery wilt and should be avoided unless you will be using it in a future cooked recipe.

How to Enjoy

A Few Quick Serving Ideas

- Add chopped celery to your favorite tuna fish or chicken salad recipe.
- Enjoy the delicious tradition of eating peanut butter on celery stalks.
- Use celery leaves in salads.
- Braise chopped celery, radicchio and onions and serve topped with walnuts and your favorite soft cheese.
- Next time you are making fresh squeezed carrot juice give it a unique taste dimension by adding some celery to it.
- Add celery leaves and sliced celery stalks to soups, stews, casseroles, and Healthy Stir-Fries.
- Consider the purchase of celery in its non-Pascal varieties. Root celery can be served as a major plate vegetable all its own, and leaf celery can be substituted for parsley in almost any recipe.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Celery, diced, raw
1.00 cup
101.00 grams

Calories: 16
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin K	29.59 mcg	33	36.6	excellent
molybdenum	5.05 mcg	11	12.5	excellent
folate	36.36 mcg	9	10.1	very good
potassium	262.60 mg	8	8.4	very good
fiber	1.40 g	6	6.2	very good
manganese	0.10 mg	5	5.6	very good
pantothenic acid	0.25 mg	5	5.6	very good
vitamin B2	0.06 mg	5	5.1	good
copper	0.04 mg	4	5.0	good
vitamin C	3.13 mg	4	4.6	good
vitamin B6	0.07 mg	4	4.6	good
calcium	40.40 mg	4	4.5	good
phosphorus	24.24 mg	3	3.9	good
magnesium	11.11 mg	3	3.1	good
vitamin A	22.67 mcg RAE	3	2.8	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Collard greens

What's New and Beneficial About Collard Greens

- The cholesterol-lowering ability of collard greens may be the greatest of all commonly eaten cruciferous vegetables. In a recent study, steamed collard greens outshined steamed kale, mustard greens, broccoli, Brussels sprouts, and cabbage in terms of its ability to bind bile acids in the digestive tract. When this bile acid binding takes place, it is easier for the bile acids to be excreted from the body. Since bile acids are made from cholesterol, the net impact of this bile acid binding is a lowering of the body's cholesterol level. It's worth noting that steamed collards show much greater bile acid binding ability than raw collards.
- We get unique health benefits from collard greens in the form of cancer protection. The cancer-preventive properties of collard greens may be largely related to 4 specific glucosinolates found in this cruciferous vegetable: glucoraphanin, sinigrin, gluconasturtiian, and glucotropaeolin. Each of these glucosinolates can be converted into an isothiocyanate (ITC) that helps lower our cancer risk by supporting our detox and anti-inflammatory systems.

WHFoods Recommendations

You'll want to include collard greens as one of the cruciferous vegetables you eat on a regular basis if you want to receive the fantastic health benefits provided by the cruciferous vegetable family. At a minimum, we recommend 3/4 cup of cruciferous vegetables on a daily basis. This amount is equivalent to approximately 5 cups per week. A more optimal intake amount would be 1-1/2 cups per day, or about 10 cups per week. You can use our Veggie Advisor for help in figuring out your best cruciferous vegetable options.

It is very important not to overcook collard greens. Like other cruciferous vegetables overcooked collard greens will begin to emit the unpleasant sulfur smell associated with overcooking. To help collard greens to cook more quickly, evenly slice the leaves into 1/2-inch slices and the stems into 1/4-inch pieces. Let them sit for at least 5 minutes to bring out the health-promoting qualities and steam for 5 minutes. Serve with our Mediterranean Dressing. See 5-Minute Collard Greens.

Collard Greens, chopped, cooked
1.00 cup
(190.00 grams)

Calories: 63
GI: very low

Nutrient	DRI/DV
vitamin K	858%
vitamin A	80%
manganese	49%
vitamin C	46%
fiber	30%
calcium	27%
choline	17%
vitamin B2	15%
vitamin B6	14%
iron	12%
copper	11%
vitamin E	11%
magnesium	10%
protein	10%
phosphorus	9%
omega-3 fats	8%
folate	8%
pantothenic acid	8%
vitamin B3	7%
vitamin B1	7%
potassium	6%

Health Benefits

Unlike broccoli and kale and cabbage, you won't find many research studies devoted to the specific health benefits of collard greens. However, collard greens are sometimes included in a longer list of cruciferous vegetables that are lumped together and examined for the health benefits they provide. Based on a very small number of studies looking specifically at collard greens, and a larger number of studies looking at cruciferous vegetables as a group (and including collard greens on the list of vegetables studied), cancer prevention appears to be a standout area for collard greens with respect to their health benefits.

This connection between collard greens and cancer prevention should not be surprising since collard greens provide special nutrient support for three body systems that are closely connected with cancer development as well as cancer prevention. These three systems are (1) the body's detox system, (2) its antioxidant system, and (3) its inflammatory/anti-inflammatory system. Chronic imbalances in any of these three systems can increase risk of cancer, and when imbalances in all three systems occur simultaneously, the risk of cancer increases significantly. Among all types of cancer, prevention of the following cancer types is most closely associated with intake of collard greens: bladder cancer, breast cancer, colon cancer, lung cancer, prostate cancer, and ovarian cancer.

Detox Support Provided by Collard Greens

The detox support provided by collard greens includes antioxidant nutrients to boost Phase 1 detoxification activities and sulfur-containing nutrients to boost Phase 2 activities. Collard greens also contain phytonutrients called glucosinolates that can help activate detoxification enzymes and regulate their activity. Four key glucosinolates that have been clearly identified in collard greens in significant amounts are glucobrassicin, glucoraphanin, gluconasturtiian, and glucotropaeolin.

If we fail to give our body's detox system adequate nutritional support, yet continue to expose ourselves to unwanted toxins through our lifestyle and our dietary choices, we can place our bodies at increased risk of toxin-related damage that can eventually increase our cells' risk of becoming cancerous. That's one of the reasons it's so important to bring collard greens and other cruciferous vegetables into our diet on a regular basis.

The Antioxidant Benefits of Collard Greens

As an excellent source of vitamin C, vitamin A (in the form of carotenoids), and manganese, and a good source of vitamin E, collard greens provide us with 4 core conventional antioxidants. But the antioxidant support provided by collard greens extends far beyond the conventional nutrients into the realm of phytonutrients. Caffeic acid, ferulic acid, quercetin, and kaempferol are among the key antioxidant phytonutrients provided by collard greens. This broad spectrum antioxidant support helps lower the risk of oxidative stress in our cells. Chronic oxidative stress—meaning chronic presence over overly reactive oxygen-containing molecules and cumulative damage to our cells by these molecules—is a risk factor for development of most cancer types. By providing us with such a great array of antioxidant nutrients, collard greens help lower our cancer risk by helping us avoid chronic and unwanted oxidative stress.

Collard Greens' Anti-inflammatory Benefits

As an excellent source of vitamin K and a good source of omega-3 fatty acids (in the form of alpha-linolenic acid, or ALA), collard greens provide us with two hallmark anti-inflammatory nutrients. Vitamin K acts as a direct regulator of our inflammatory response, and ALA is the building block for several of the body's most widely-used families of anti-inflammatory messaging molecules. In addition to these two anti-inflammatory components, one of the glucosinolates found in collard greens—glucobrassicin—can be readily converted into an isothiocyanate molecule called I3C, or indole-3-carbinol (I3C). I3C is an anti-inflammatory compound that can actually operate at the genetic level, and by doing so, prevent the initiation of inflammatory responses at a very early stage.

Like chronic oxidative stress and chronic weakened detox ability, chronic unwanted inflammation can significantly increase our risk of cancers and other chronic diseases (especially cardiovascular diseases).

Collard Greens and Cardiovascular Support

Researchers have looked at a variety of cardiovascular problems—including heart attack, ischemic heart disease, and atherosclerosis—and found preliminary evidence of an ability on the part of cruciferous vegetables to lower our risk of these health problems. Yet regardless of the specific cardiovascular problem, it is one particular type of cardiovascular benefit that has most interested researchers, and that benefit is the anti-inflammatory nature of collard greens and their fellow cruciferous vegetables. Scientists have not always viewed cardiovascular problems as having a central inflammatory component, but the role of unwanted inflammation in creating problems for our blood vessels and circulation has become increasingly fundamental to an understanding of cardiovascular diseases. Of particular interest here has been the isothiocyanate (ITC) sulforaphane, which is made from glucoraphanin (a glucosinolate) found in collard greens. Not only does this ITC trigger anti-inflammatory activity in our cardiovascular system, it may also be able to help prevent and even possibly help reverse blood vessel damage.

A second area you can count on collard greens for cardiovascular support involves their cholesterol-lowering ability. Our liver uses cholesterol as a basic building block to product bile acids. Bile acids are specialized molecules that aid in the digestion and absorption of fat through a process called emulsification. These molecules are typically stored in fluid in our gall bladder, and when we eat a fat-containing meal, they get released into the intestine where they help ready the fat for interaction with enzymes and eventual absorption up into the body. When we eat collard greens, fiber-related nutrients in this cruciferous vegetable bind together with some of the bile acids in the intestine in such a way that they simply stay inside the intestine and pass out of our body in a bowel movement, rather than getting absorbed along with the fat they have emulsified. When this happens, our liver needs to replace the lost bile acids by drawing upon our existing supply of cholesterol, and as a result, our cholesterol level drops down. Collard greens provide us with this cholesterol-lowering benefit whether they are raw or cooked. However, a recent study has shown that the cholesterol-lowering ability of raw collard greens improves significantly when they are steamed. In fact, when the cholesterol-lowering ability of steamed collard greens was compared with the cholesterol-lowering ability of the prescription drug cholestyramine (a medication that is taken for the purpose of lowering cholesterol), collard greens bound 46% as many bile acids (based on a standard of comparison involving total dietary fiber).

In addition to the support factors described above, it would be wrong to talk about the cardiovascular benefits of collard greens without mentioning their diverse array of B vitamins. Collard greens are a very good source of vitamins B2, B6, and choline, and a good source of vitamins B1, B3, folate, and pantothenic acid. A well-balanced intake of B vitamins - especially vitamins B6, B12, folate, and choline - can be important in controlling cardiovascular disease risk. Since excessive or deficient intake of these B vitamins can have an unwanted impact on your disease risk, it is great to have a food like collard greens that provide a helpful amount of so many B vitamins.

Collard Greens and Digestive Support

The fiber content of collard greens—over 7 grams in every cup—makes this cruciferous vegetable a natural choice for digestive system support. Yet the fiber content of collard greens is only one of their digestive support mechanisms. Researchers have determined that the sulforaphane made from a glucosinolate in collard greens (glucoraphanin) helps protect the health of our stomach lining by preventing bacterial overgrowth of *Helicobacter pylori* in our stomach or too much clinging by this bacterium to our stomach wall.

Other Health Benefits From Collard Greens

The anti-inflammatory nature of glucosinolates/isothiocyanates and other nutrients found in collard greens has been the basis for new research on inflammation-related health problems and the potential role of collard greens in their prevention. Current and potentially promising research is underway to examine the benefits of collard greens in relationship to our risk of the following inflammation-related conditions: Crohn's disease, inflammatory bowel disease, insulin resistance, irritable bowel syndrome, metabolic syndrome, obesity, rheumatoid arthritis, type 2 diabetes, and ulcerative colitis.

Description

All cruciferous vegetables provide integrated nourishment across a wide variety of nutritional categories and provide broad support across a wide variety of body systems as well. For more on cruciferous vegetables see:

- Eating Healthy with Cruciferous Vegetables
- Feeling Great with Cruciferous Vegetables

Collards are leafy green vegetables that belong to the same family that includes cabbage, kale, and broccoli. While they share the same botanical name as kale, Brassica oleracea, and some resemblance, they have their own distinctive qualities. Like kale, collards are one of the non-head forming members of the Brassica family. Collards' unique appearance features dark blue green leaves that are smooth in texture and relatively broad. They lack the frilled edges that are so distinctive to their cousin kale.

Long a staple of the Southern United States, collard greens, unlike their cousins kale and mustard greens, have a very mild, almost smoky flavor. Although they are available year-round they are at their best from January through April.

History

Like kale, cauliflower and broccoli, collards are descendents of the wild cabbage, a plant thought to have been consumed as food since prehistoric times and to have originated in Asia Minor. From there it spread into Europe, being introduced by groups of Celtic wanderers around 600 B.C. Collards have been cultivated since the times of the ancient Greek and Roman civilizations. While collards may have been introduced into the United States before, the first mention of collard greens dates back to the late 17th century. Collards are an integral food in traditional southern American cuisine.

How to Select and Store

Look for collard greens that have firm, unwilted leaves that are vividly deep green in color with no signs of yellowing or browning. Leaves that are smaller in size will be more tender and have a milder flavor. They should be displayed in a chilled section in the refrigerator case to prevent them from wilting and becoming bitter.

Place collard greens in a plastic bag, removing as much of the air from the bag as possible. Store in the refrigerator where they should keep fresh for about three to five days. Loss of some nutrients in collard greens—for example, its vitamin C content—is likely to be slowed down through refrigeration.

How to Enjoy

A Few Quick Serving Ideas

- Serve steamed collard greens with black-eyed peas and brown rice for a Southern-inspired meal.
- Use lightly steamed, cooled, and chopped collard greens as a filling in your sushi vegetable rolls.

WHFoods Recipes That Feature Collard Greens

- Poached Eggs Over Collard Greens & Shiitake Mushrooms
- Italian Navy Bean Soup with Rosemary
- Zesty Mexican Soup
- 5-Minute Collard Greens
- Pinto Beans with Collard Greens
- Steamed Vegetable Medley

Safety

Collard Greens and Goitrogens

You may sometimes hear collard greens being described as a food that contains "goitrogens," or as a food that is "goitrogenic." For helpful information in this area—including our WHFoods Recommendations—please see our article What is meant by the term "goitrogen" and what is the connection between goitrogens, food, and health?.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Collard Greens, chopped, cooked
1.00 cup
190.00 grams

Calories: 63
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating

vitamin K	772.54 mcg	858	246.4	excellent
vitamin A	722.00 mcg RAE	80	23.0	excellent
manganese	0.97 mg	49	13.9	excellent
vitamin C	34.58 mg	46	13.2	excellent
fiber	7.60 g	30	8.7	excellent
calcium	267.90 mg	27	7.7	excellent
choline	72.96 mg	17	4.9	very good
vitamin B2	0.20 mg	15	4.4	very good
vitamin B6	0.24 mg	14	4.1	very good
iron	2.15 mg	12	3.4	very good
vitamin E	1.67 mg (ATE)	11	3.2	good
copper	0.10 mg	11	3.2	good
protein	5.15 g	10	3.0	good
magnesium	39.90 mg	10	2.9	good
phosphorus	60.80 mg	9	2.5	good
pantothenic acid	0.41 mg	8	2.4	good
folate	30.40 mcg	8	2.2	good
omega-3 fats	0.18 g	8	2.2	good
vitamin B3	1.09 mg	7	2.0	good
vitamin B1	0.08 mg	7	1.9	good
potassium	222.30 mg	6	1.8	good

World's Healthiest Foods Rating	**Rule**
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Corn

What food is more synonymous with summer than freshly picked corn on the cob? Corn grows in "ears," each of which is covered in rows of kernels that are then protected by the silk-like threads called "corn silk" and encased in a husk. Corn is known scientifically as *Zea mays*. This moniker reflects its traditional name, maize, by which it was known to the Native Americans as well as many other cultures throughout the world. Although we often associate corn with the color yellow, it actually comes in host of different varieties featuring an array of different colors, including red, pink, black, purple, and blue. Although corn is now available in markets year-round, it is the locally grown varieties that you can purchase during the summer months that not only tastes the best but are usually the least expensive.

What's New and Beneficial about Corn

- You can get health-supportive antioxidant benefits from all varieties of corn, including white, yellow, blue, purple and red corn. But recent research has shown the antioxidant benefits from different varieties of corn actually come from different combinations of phytonutrients. In the case of yellow corn, it's the antioxidant carotenoids leading the way, with especially high concentrations of lutein and zeaxanthin. In the case of blue corn, it's the anthocyanins. There's one particular hydroxybenzoic acid in purple corn—protocatechuic acid—that's also been recently linked to the strong antioxidant activity in this corn variety.
- In research on carotenoid antioxidants in food, there has been ongoing debate over the availability of all carotenoids in any particular food if one or two specific carotenoids are present in unusually high amounts. Because yellow corn is a high-carotenoid food that contains highly differing amounts of individual carotenoids, researchers have long wondered whether it is possible to get health benefits from all of the carotenoids in yellow corn when their concentrations are sometimes so different. In yellow cornmeal, the carotenoids lutein and zeaxanthin fall into the high concentration category and reach a level of 1,355 micrograms per 100 grams. That level is nearly 14 times as high as the level of beta-carotene (97 micrograms per 100 grams). But thanks to recent research, we now know that absorption of beta-carotene from yellow cornmeal is only mildly compromised by the high levels of lutein and zeaxanthin in the cornmeal. In other words, in terms of carotenoid nourishment, we appear to get health benefits from all of corn's diverse carotenoids!
- We correctly think about corn as a good source of fiber. Corn is a food that gives us plenty of chewing satisfaction, and its high ratio of insoluble-to-soluble fiber is partly the reason. Past researchers have not been clear, however, about the ability of corn fiber to nourish our lower digestive tract. When you look at foods as a whole, they contain many different types of fiber, and when certain types of fiber reach the lower part of our large intestine (especially certain types of soluble fiber) they can be metabolized by intestinal bacteria into short chain fatty acids (SCFAs). This process not only helps support healthy populations of friendly bacteria in our large intestine, but also provides a direct supply of energy (in the form of SCFAs) to the cells that line our large intestine. With this benefit of this extra SCFA energy supply, our intestinal cells can stay healthier and function at a lower risk of becoming cancerous. Recent research has shown that corn can support the growth of friendly bacteria in our large intestine and can also be transformed by these bacteria into SCFAs. These SCFAs can supply energy to our intestinal cells and thereby help lower our risk of colon cancer. The amount of corn fiber analyzed in recent studies has been relatively high at 12 grams per day. That's the same amount provided by about 2.5 cups of fresh corn. While that amount might be more than you would consume at a single meal, it's an amount that you might easily consume over the course of several days. We suspect that future research will demonstrate the risk-reducing effects of smaller amounts of corn consumed over a longer period of time.

Corn, yellow, cooked
1.00 each
(77.00 grams)

Calories: 74
GI: medium

Nutrient	DRI/DV
pantothenic acid	12%
phosphorus	8%
vitamin B3	8%
manganese	7%
fiber	7%
vitamin B6	6%

Health Benefits

Corn has gathered a diverse reputation in the U.S. For some people, corn is a "staple" food that provides the foundation for tortillas, burritos, or polenta. For others, corn is a "snack" food that comes in the form of popcorn and corn chips. For still others, corn is a "special summertime food" that is essential at barbecues and cookouts. But regardless of its reputation, corn is seldom considered in the U.S. as a unique source of health benefits. Yet that's exactly what research results are telling us about this amazing grain.

Antioxidant Benefits

While it might sound surprising to some people who are used to thinking about corn as a plain, staple food, or a snack food, or a summertime party food, corn is actually a unique phytonutrient-rich food that provides us with well-documented antioxidant benefits. In terms of conventional antioxidant nutrients, corn is a good source of the mineral manganese. But it is corn's phytonutrients that have taken center stage in the antioxidant research on corn. When all varieties of corn are considered as a group, the list of corn's key antioxidant nutrients appears as follows:

Antioxidant Phytonutrients in Corn

- anthocyanins
- beta-carotene
- caffeic acid
- coumaric acid
- ferulic acid
- lutein
- syringic acid
- vanillic acid
- protocatechuic acid
- zeaxanthin

Different varieties of corn highlight different combinations of antioxidant phytonutrients. In the case of yellow corn, carotenoids lead the way and provide especially high concentrations of lutein and zeaxanthin. Blue corn is unique in its anthocyanin antioxidants. One particular hydroxybenzoic acid in purple corn—protocatechuic acid—has recently been linked to the strong antioxidant activity in this corn variety.

Most studies of disease and risk reduction from dietary antioxidant intake have not looked specifically at corn and its impressive combination of antioxidants. However, in several small-scale studies, corn has been directly mentioned as a food that was important in overall antioxidant protection and a contributing factor in the decreased risk of cardiovascular problems. Some of the mechanisms for decreased cardio risk may be related to other properties of corn's phytonutrients that go beyond their antioxidant properties. For example, some of the phytonutrients in corn may be able to inhibit angiotensin-I converting enzyme (ACE) and help lower risk of high blood pressure in this way. We suspect that future studies will further confirm the important role of corn's phytonutrients in reduction of risk for a variety of health problems, and that antioxidant and other properties will play a key role in this risk reduction.

One great piece of news about corn's antioxidants involves the practice of drying corn (still on the cob) or separated corn kernels. Research studies have shown that the drying of corn in temperature ranges as high as 150°-200°F (65°-93°C) does not significantly lower corn's antioxidant capacity. This research confirms the wisdom of many North American and Mesoamerican cultures which relied on naturally-dried corn in the preparation of meal foods, especially during the winter months.

Interestingly, recent research has determined that the percent of amylose starch found in corn may be related to its antioxidant capacity. Higher amylose corn varieties have shown higher antioxidant capacity in some preliminary studies. While the jury is out on the exact meaning of these findings, this research reminds us to keep an open mind about the potential importance of antioxidant health benefits from corn.

Digestive Benefits

Anyone who has eaten fresh corn-on-the-cob or freshly popped popcorn knows how satisfying this food can be to chew. Some of that satisfaction comes from corn's fiber content. At 4.6 grams of fiber per cup, corn is a good fiber source, and in research studies, corn intake is often associated with good overall fiber intake. For example, persons who eat popcorn tend to have 2-3 times more overall whole grain intake than persons who do not eat popcorn, and they also tend to have higher overall fiber intake as well.

Corn fiber is one of the keys to its well-documented digestive benefits. Recent research has shown that corn can support the growth of friendly bacteria in our large intestine and can also be transformed by these bacteria into short chain fatty acids, or SCFAs. These SCFAs can supply energy to our intestinal cells and thereby help lower our risk of intestinal problems, including our risk of colon cancer. The amount of corn fiber analyzed in recent studies has been relatively high at 12 grams per day. That's the same amount provided by about 2.5 cups of fresh corn. While that amount might be more than any person would consume in a single meal, it's an amount that a person might easily eat over the course of several days. We suspect that future research will demonstrate the risk-reducing effects of smaller amounts of corn consumed over a longer period of time.

Blood Sugar Benefits

Given its good fiber content, its ability to provide many B-complex vitamins including vitamins B1, B5 and folic acid, and its notable protein content (about 5-6 grams per cup), corn is a food that would be expected to provide blood sugar benefits. Fiber and protein are key macronutrients for stabilizing the passage of food through our digestive tract. Sufficient fiber and protein content in a food helps prevent too rapid or too slow digestion of that food. By evening out the pace of digestion, protein and fiber also help prevent too rapid or too slow uptake of sugar from the digestive tract up into the bloodstream. Once the uptake of sugar is steadied, it is easier to avoid sudden spikes or drops in blood sugar.

Consumption of corn in ordinary amounts of 1-2 cups has been shown to be associated with better blood sugar control in both type 1 and type 2 diabetes. Fasting glucose and fasting insulin levels have been used to verify these blood sugar benefits. Interestingly, in elementary school-age and teenage youths already diagnosed with type 1 diabetes, whole grain cornbread has emerged in one study as the whole grain food with the highest acceptability among all whole grain foods. Youth participants in the study who consumed whole grain cornbread were also less likely to consume fast foods.

Other Benefits

In countries outside of the U.S., numerous studies have examined the ability of corn to improve overall nourishment, especially when combined with legumes. Researchers conducting these studies have been interested in absorption of minerals like zinc, calcium and iron, as well as overall energy and protein intake. Maize (corn)-bean meals (typically consumed in the form of porridge that combines these foods) have been shown to help improve overall nutrient status and to help provide outstanding nutrient richness in the diet.

One fascinating new area of research on corn involves its potential anti-HIV activity. Lectins are special proteins found in virtually all foods (and for that matter, in virtually all organisms) that can bind onto carbohydrates or onto carbohydrate receptors that are found on cell membranes. In the case of some micro-organisms (including the HIV virus), the binding of lectins onto sugars has been shown to help inhibit activity of the virus. One specific lectin found in corn (called GNAmaize) has preliminarily been shown to possess this HIV-inhibiting property. Of course, much more research is needed to determine the relationship between everyday consumption of corn as a whole food and HIV infection risk.

Description

While the kernels that we commonly call "corn" are technically the fruit of the plant *Zea mays*, corn is widely classified as a grain and is typically included in research studies of whole grain foods like wheat, oats, and barley. Throughout much of the world, corn is referred to as "maize." In many ways, "maize" is the best way of describing this plant since it was first domesticated in Mesoamerica over 8,000 years ago and was originally described using the Spanish word "maiz." This remarkable food took on sacred qualities for many Central American and South American cultures, as well as many Native American tribes in what is now the United States.

All types of corn come from the same genus and species of plant, *Zea mays*. However, within this genus and species, there are well over 100 subspecies and varieties. Many different subspecies are most familiar to consumers in terms of color. White, yellow, pink, red, blue, purple, and black corn are all varieties of *Zea mays*. Each of these varieties contains its own unique health-supportive combination of antioxidant phytonutrients. In the case of yellow corn, there's a greater concentration of carotenoids, especially lutein and zeaxanthin. With blue corn, there's a richer supply of anthocyanins. In purple corn, there's one particular hydroxybenzoic acid—protocatechuic acid—that's been recently linked to this variety's antioxidant capacity.

History

Perhaps no other food has been more closely identified with the Americas than corn. Both the Mayan and the Olmec civilizations that date back to 2000-1500 BC in what is now Mexico and Central America (commonly called Mesoamerica) had not only adopted maize as a staple food in the diet but had also developed a reverence for maize that was expressed in everyday rituals, religious ceremonies, and in the arts. The first domestication of maize in Mesoamerica actually dates back even further, to 9000-8000 BC. Corn was equally valued by Native American tribes living in North America, although tribal wisdom about corn was largely ignored by European colonists in the 15th and 16th centuries AD.

By the time Columbus and other explorers arrived in North America, corn was already an integral part of Native American cuisine. However, many colonists ignored Native American traditions related to corn—including the pot ash tradition—and later fell victim to the vitamin B3 deficiency disease called *pellagra*. (When cooking corn and cornmeal, Native Americans had developed a practice of incorporating ash from the fire into the food, and the mineral mix in this ash increased the bioavailability of vitamin B3 from the corn. The addition of lime in the form of calcium hydroxide to tortillas still serves this purpose today.)

While the average U.S. adult does not share the reverence for corn that characterized the practices of Native Americans and indigenous peoples of Mesoamerica, there is still an amazing influence of corn on the U.S. diet. Forty percent of all processed, pre-packaged foods sold in U.S. groceries currently contain some processed component of corn, although this component is most often high fructose corn syrup (HFCS). Per capita consumption of corn in all forms is approximately 160 pounds in the U.S. (and approximately 60-65 pounds come in the form of HFCS). U.S. farmers grow about 40% of all corn produced worldwide. An important region of the U.S. is still identified as the "Corn Belt." This region is typically defined as including Iowa, Illinois, the eastern parts of Nebraska and Kansas as well as North and South Dakota, the southern part of Minnesota, and parts of northern Missouri as well as Ohio and Indiana. However, Iowa, Illinois, Nebraska and Minnesota remain the top producers of corn in the U.S. and provide over 50% of all U.S. corn crops.

An increasing trend in U.S. production of corn has been cultivation for non-food purposes. Addition of ethanol to gasoline and biofuel production have been two important factors in the shift away from food-based cultivation of corn. The cultivation of corn for ethanol production has also led to an increased supply of ethanol by-products that have found their way into the marketplace. An example here is distillers dried grains, or DDGs. DDGs have already become an important part of livestock feed, along with other corn components.

Along with the United States, other important commercial producers of corn currently include China, Brazil, Mexico, Russia, Ukraine, Romania, and South Africa.

How to Select and Store

From a food safety standpoint, we recommend selection of corn that has not been exposed to any substantial amount of heat. Exposure to excess heat can increase the susceptibility of fresh corn to microbial contamination. If you are shopping in the grocery store, your safest bet is corn that is being displayed in a refrigerated produce bin. Next safest would be corn that, while not refrigerated, is still being displayed in a cool store location, out of direct sun and not near a heat source. These same recommendations apply for corn in a farmer's market or roadside stand. Here display of corn in the shade and out of direct sunlight can be important from a food safety standpoint.

Look for corn whose husks are fresh and green and not dried out. They should envelope the ear and not fit too loosely around it. To examine the kernels, gently pull back on part of the husk. The kernels should be plump and tightly arranged in rows. Due to changes that have occurred over time in commercial corn production, corn has become a food where quality is especially important. Over 70% of all corn found in U.S. grocery stores has been genetically modified in the form of herbicide-tolerant, or HT corn, or the form of insect-resistant, or Bt corn. (Bt corn gets its name from the transfer of a gene from the soil bacterium, *Bacillus thuringiensis*, into the corn. A protein toxin produced by this bacterium helps to kill certain insects that might otherwise eat the corn.) While there is no large scale human research on GE corn and its health impact, we share the concern of many researchers about the introduction of novel proteins into food and their potential for increasing risk of adverse reactions, including food allergies. One way to avoid these potential GE risks is to select certified organic corn, since GE modifications are not allowed in certified organic food.

Non-organic, conventionally grown corn has repeatedly been shown to contain organochlorine pesticide residues. In one study, 19 different pesticide residues were found on samples of conventionally grown corn. Like potential GE risks, potential pesticide risks can be avoided through selection of certified organic corn.

Traditionally to enjoy the optimal sweetness of fresh corn, it was recommended to eat it the day of purchase. New varieties allow you 3 days to still enjoy its full flavor. Store corn in an air-tight container or tightly wrapped plastic bag in the refrigerator if you do not intend to cook it on the day of purchase. Do not remove its husk since this will protect its flavor.

Fresh corn freezes well if placed in heavy-duty freezer bags. To prepare whole ears for freezing, blanch them first for five minutes depending. If you just want to freeze the kernels, first blanch the ears and then cut the kernels off the cob at about three-quarters of their depths. Frozen whole corn on the cob will keep for up to one year, while the kernels can be frozen for two to three months.

How to Enjoy

A Few Quick Serving Ideas

- Eat corn on the cob either just as is or seasoned with a little organic butter, olive oil or flaxseed oil, salt and pepper, nutritional yeast or any other herbs or spices you enjoy.
- Healthy sauté cooked corn with green chilies and onions. Served hot, this makes a wonderful side dish.
- Enjoy a cold salad with an ancient Incan influence by combining cooked corn kernels, quinoa, tomatoes, green peppers and red kidney beans.
- Use polenta (a type of cornmeal) as a pizza crust for a healthy pizza.
- Add corn kernels and diced tomatoes to guacamole to give it extra zing.
- Adding corn to soup, whether it chili or chowder, enhances the soup's hardiness, let alone its nutritional profile.

WHFoods Recipes That Feature Corn

- Hot Polenta Breakfast with Dried Fruit Compote
- 15-Minute Black Bean Salad
- Kidney Bean Salad with Mediterranean Dressing
- Zesty Mexican Soup
- Black Bean Chili
- Polenta, Onion and Gorgonzola Pizza
- Healthy Creamed Corn
- Steamed Mexican Corn on the Cob

Safety

Genetically Modified Corn

Conventionally grown corn is one of the foods that is often grown from genetically modified seeds. For helpful information about genetically modified foods—including our WHFoods Recommendations—please see our article, What Is Your Approach to Genetically Modified Foods?

Other Controversies

Some animal foods and some plants foods have been the subject of ongoing controversy that extends well beyond the scope of food, nutrient-richness, and personal health. This controversy often involves environmental issues, or issues related to the natural lifestyle of animals or to the native habitat for plants. Corn has been a topic of ongoing controversy in this regard. Our Controversial Foods Q & A will provide you with more detailed information about these issues.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Corn, yellow, cooked **1.00 each** **77.00 grams**			**Calories: 74** **GI: medium**
	DRI/DV	**Nutrient**	**World's Healthiest**

Nutrient	Amount	(%)	Density	Foods Rating
pantothenic acid	0.61 mg	12	3.0	good
phosphorus	59.29 mg	8	2.1	good
vitamin B3	1.30 mg	8	2.0	good
fiber	1.85 g	7	1.8	good
manganese	0.13 mg	7	1.6	good
vitamin B6	0.11 mg	6	1.6	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Cucumbers

Cucumbers are scientifically known as *Cucumis sativus* and belong to the same botanical family as melons (including watermelon and cantaloupe) and squashes (including summer squash, winter squash, zucchini and pumpkin). Commercial production of cucumbers is usually divided into two types. "Slicing cucumbers" are produced for fresh consumption. "Pickling cucumbers" are produced for eventual processing into pickles. Slicing cucumbers are usually larger and have thicker skins, while pickling cucumbers are usually smaller and have thinner skins.

What's New and Beneficial About Cucumbers

- Researchers have long been familiar with the presence of unique polyphenols in plants called lignans, and these health-benefiting substances have been studied extensively in cruciferous vegetables (like broccoli or cabbage) and allium vegetables (like onion or garlic). Recent studies, however, have begun to pay more attention to the lignan content of other vegetables, including cucumbers. Cucumbers are now known to contain lariciresinol, pinoresinol, and secoisolariciresinol—three lignans that have a strong history of research in connection with reduced risk of cardiovascular disease as well as several cancer types, including breast, uterine, ovarian, and prostate cancers.
- Fresh extracts from cucumbers have recently been show to have both antioxidant and anti-inflammatory properties. While research in this area must still be considered preliminary—since it's only been conducted on animals in a lab setting—the findings are clear and consistent. Substances in fresh cucumber extracts help scavenge free radicals, help improve antioxidant status, inhibit the activity of pro-inflammatory enzymes like cyclo-oxygenase 2 (COX-2), and prevent overproduction of nitric oxide in situations where it could pose health risks. It's highly likely that cucumber phytonutrients play a key role in providing these antioxidant and anti-inflammatory benefits, supporting health alongside of the conventional antioxidant nutrients—including vitamin C, beta-carotene, and manganese—of which cucumbers are an important source.
- As a member of the *Cucurbitaceae* family of plants, cucumbers are a rich source of triterpene phytonutrients called cucurbitacins. Cucurbitacins A, B, C, D and E are all contained in fresh cucumber. They have been the subject of active and ongoing research to determine the extent and nature of their anti-cancer properties. Scientists have already determined that several different signaling pathways (for example, the JAK-STAT and MAPK pathways) required for cancer cell development and survival can be blocked by activity of cucurbitacins. We expect to see human studies that confirm the anti-cancer benefits of cucumbers in the everyday diet.

Cucumber, sliced, raw
1.00 cup
(104.00 grams)

Calories: 16
GI: very low

Nutrient	DRI/DV
vitamin K	19%
molybdenum	12%
pantothenic acid	5%
potassium	4%
phosphorus	4%
copper	4%
manganese	4%
vitamin C	4%
vitamin B1	3%
biotin	3%
magnesium	3%

Health Benefits

Cucumbers have not received as much press as other vegetables in terms of health benefits, but this widely cultivated food provides us with a unique combination of nutrients. At the top of the phytonutrient list for cucumbers are its cucurbitacins, lignans, and flavonoids. These three types of phytonutrients found in cucumbers provide us with valuable antioxidant, anti-inflammatory, and anti-cancer benefits. Specific phytonutrients provided by cucumbers include

Flavonoids

- apigenin
- a luleolin
- a quercetin
- a kaempferol

Lignans

- pinoresinol
- lariciresinol
- secoisolariciresinol

Triterpenes

- cucurbitacin A
- cucurbitacin B
- cucurbitacin C
- cucurbitacin D

Details about the best-researched health benefits of cucumbers are provided in the paragraphs below.

Antioxidant & Anti-Inflammatory Benefits

Cucumbers are a valuable source of conventional antioxidant nutrients including vitamin C, beta-carotene, and manganese. In addition, cucumbers contain numerous flavonoid antioxidants, including quercetin, apigenin, luteolin, and kaempferol. In animal studies, fresh extracts from cucumber have been shown to provide specific antioxidant benefits, including increased scavenging of free radicals and increased overall antioxidant capacity. Fresh cucumber extracts have also been shown to reduce unwanted inflammation in animal studies. Cucumber accomplishes this task by inhibiting activity of pro-inflammatory enzymes like cyclo-oxygenase 2 (COX-2), and by preventing overproduction of nitric oxide in situations where it could increase the likelihood of excessive inflammation.

Anti-Cancer Benefits

Research on the anti-cancer benefits of cucumber is still in its preliminary stage and has been restricted thus far to lab and animal studies. Interestingly, however, many pharmaceutical companies are actively studying one group of compounds found in cucumber—called cucurbitacins—in the hope that their research may lead to development of new anti-cancer drugs. Cucurbitacins belong to a large family of phytonutrients called triterpenes. Cucurbitacins A, B, C, D and E have all been identified within fresh cucumber. Researchers have determined that several different signaling pathways (for example, the JAK-STAT and MAPK pathways) required for cancer cell development and cancer cell survival can be blocked by activity of cucurbitacins. Eventually, we expect to see human studies that confirm the anti-cancer benefits of cucumbers when consumed in a normal, everyday meal plan.

A second group of cucumber phytonutrients known to provide anti-cancer benefits are its lignans. The lignans pinoresinol, lariciresinol, and secoisolariciresinol have all been identified within cucumber. Interestingly, the role of these plant lignans in cancer protection involves the role of bacteria in our digestive tract. When we consume plant lignans like those found in cucumber, bacteria in our digestive tract take hold of these lignans and convert them into enterolignans like enterodiol and enterolactone. Enterolignans have the ability to bind onto estrogen receptors and can have both pro-estrogenic and anti-estrogenic effects. Reduced risk of estrogen-related cancers, including cancers of the breast, ovary, uterus, and prostate has been associated with intake of dietary lignans from plant foods like cucumber.

Description

Even though long, dark green, smooth-skinned garden cucumbers are familiar vegetables in the produce sections of most groceries, cucumbers actually come in a wide variety of colors, sizes, shapes and textures. You'll find white, yellow, and even orange-colored cucumbers, and they may be short, slightly oval, or even round in shape. Their skins can be smooth and thin, or thick and rough. In a technical sense, cucumbers are actually fruits, not vegetables. (Fruits are parts of flowering plants that come from the ovary.) But we've become accustomed to thinking and referring to cucumbers as vegetables.

All cucumbers belong to the botanical plant family called *Curcubitaceae*. This broad family of plants includes melons and squashes. The cucumbers we're most familiar with in the grocery store belong to the specific genus/species group, *Cucumis* *sativus*.

While there are literally hundreds of different varieties of Cucumis sativus, virtually all can be divided into two basic types: slicing and pickling. Slicing cucumbers include all varieties that are cultivated for consumption in fresh form. In the United States, commonly planted varieties of slicing cucumber include Dasher, Conquistador, Slicemaster, Victory, Comet, Burpee Hybrid, and Sprint. These varieties tend to be fairly large in size and thick-skinned. Their size makes them easier for slicing, and their thick skin makes them easier to transport in whole food form without damage. (In many other countries, however, slicing cucumbers may be smaller in size and may be much more thinly skinned.)

Pickling cucumbers include all varieties that are cultivated not for consumption in fresh form, but for processing into pickles. In the United States, commonly planted varieties of pickling cucumber include Royal, Calypso, Pioneer, Bounty, Regal, Duke, and Blitz. Some of these pickling varieties are black-spine types (in reference to the texture of their outer skin) and some are white-spine. While pickling cucumbers can always be eaten fresh, their smaller size and generally thinner skins make them easier to ferment and preserve/jar.

Pickling is a process than can be used for many different foods. It's not limited to cucumbers and or even to the vegetable food group. In general, the word "pickling" refers to a method of preventing food spoilage that involves soaking in a liquid and/or fermenting.

While the language used to describe pickles can be very confusing, there are only two basic types of pickles: fermented and non-fermented. Fermenting is a process in which fresh foods (in this case cucumbers) are allowed to soak in a solution for an extended period of time that allows microorganisms to make changes in the food. Among these changes is a build-up of lactic acid that serves to protect the pickles from spoilage. When fermented in an appropriate solution, fresh foods like cucumbers can be transformed in a way that greatly increases their shelf life. Cucumbers are typically fermented in brine (water that's been highly saturated in salt). In fact, the word "pickle" actually comes from the Dutch "pekel" meaning brine. Alongside of salt, pickling brines often contain other ingredients, including vinegar, dill seed, garlic, and lime (calcium hydroxide or calcium oxide). "Dill pickles" get their name from the addition of dill seed to the brine. "Kosher dills" are brined not only with dill, but also with garlic. (One important note in this regard: "kosher dills" are not necessarily pickled cucumbers that have been prepared according to kosher dietary laws. The word "kosher" in their name often refers to a general style of preparation in which a good bit of garlic has been used in the brining process. If you are seeking pickles that have been prepared according to kosher dietary laws, look for "certified kosher" on the label, not just "kosher" or "kosher-style.")

Fermented pickles are often called "brined pickles," but here's where confusion can set it. These two terms aren't truly interchangeable since some brined pickles are "quick brined" and haven't been given time for fermentation. When pickles are "quick brined," the brining solution usually contains a significant amount of vinegar, and it's this added vinegar that prevents the pickles from spoiling, not build up of lactic acid through the microbial fermentation process. Non-fermented pickles of all kinds—often referred to as "quick pickled"—rely on the addition of vinegar or another highly-acidic solution to prevent spoilage. "Quick pickling" with the use of vinegar can be accomplished in a matter of days. Pickling by fermentation usually takes a minimum of several weeks. If you would like to learn more about how pickled cucumbers compare in nutritional value to raw cucumbers, see this Q+A .

While genetically engineered cucumbers do exist, genetic engineering is not responsible for the existence of seedless varieties of cucumbers. Through a natural process called parthenogenesis, cucumber plants can fruit without pollen. In the absence of pollen, seeds do not develop in the fruit. While some people have a personal preference for seedless cucumbers, it's worth remembering that cucumber seeds are rich source of cucumber nutrients that are sometimes absent in the pulp and skin.

Sometimes you will hear the word "gherkin" being used to refer to cucumbers and pickles. This word can be used to describe a variety of cucumber that comes from the same plant species (Cucumis sativus) that is the source of most other cucumber varieties found in the grocery. But the term "gherkin" can also be used to describe a cucumber variety that comes from a different species of plant (*Cucumis anguiria*).

History

Cucumber plants naturally thrive in both temperate and tropical environments, and generally require temperatures between 60-90°F/15-33°C. For this reason, they are native to many regions of the world. In evolutionary terms, the first cucumbers were likely to have originated in Western Asia (and perhaps more specifically in India) or parts of the Middle East. Cucumbers are mentioned in the legend of Gilgamesh—a Uruk king who lived around 2500 BC in what is now Iraq and Kuwait. It was approximately 3,300 years later when cucumber cultivation spread to parts of Europe, including France. And it was not until the time of the European colonists that cucumbers finally appeared in North America in the 1500's.

Today, the states of Florida and California are able to provide U.S. consumers with fresh cucumbers for most of the year (from March through November). Imported cucumbers from Mexico are commonly found in groceries during the winter months of December, January, and February. In California alone, about 6,600 acres are planted with slicing cucumber varieties and 4,400 with pickling cucumbers. Worldwide, China is by far the largest producer of cucumbers, and provides about two-thirds of the global supply. Iran, Turkey, Russia, Egypt, Spain, Mexico, the Ukraine, Japan, Indonesia, and the U.S. all participate in the world cucumber market, with an especially high number of exports coming from Iran, Mexico, and Spain. Annual production of cucumbers worldwide is approximately 84 billion pounds.

How to Select and Store

Since cucumbers can be very sensitive to heat, you'll be on safer grounds if you choose those that are displayed in refrigerated cases in the market. They should be firm, rounded at their edges, and their color should be a bright medium to dark green. Avoid cucumbers that are yellow, puffy, have sunken water-soaked areas, or are wrinkled at their tips.

We address the issue of seeds and skins in our "Healthiest Way of Preparing Cucumbers" section below. But during the selection process, you may find it helpful to know that thin-skinned cucumbers will generally have fewer seeds than those that are thick-skinned.

Cucumbers should be stored in the refrigerator where they will keep for several days. Loss of some nutrients in cucumber—for example, its vitamin C content—is likely to be slowed down through refrigeration. If you do not use the entire cucumber during one meal, place it in a tightly sealed container so that it does not become dried out. For maximum quality, cucumber should be used within one or two days. Cucumbers should not be left out at room temperature for too long as this will cause them to wilt and become limp.

How to Enjoy

A Few Quick Serving Ideas

- Use half-inch thick cucumber slices as petite serving "dishes" for chopped vegetable salads.
- Mix diced cucumbers with sugar snap peas and mint leaves and toss with rice wine vinaigrette.
- For refreshing cold gazpacho soup that takes five minutes or less to make, simply purée cucumbers, tomatoes, green peppers and onions, then add salt and pepper to taste.
- Add diced cucumber to tuna fish or chicken salad recipes.

WHFoods Recipes That Feature Cucumbers

- Healthy Chef's Salad with Walnuts and French Dressing
- Healthy Chicken Caesar Salad
- Healthy Veggie Salad
- Salad Nicoise
- Salmon, Cucumber, Dill Salad
- Seared Tuna Salad
- Seafood Gazpacho
- Salmon with Cucumber Chili Salad
- 5-Minute Cold Cucumber Salad
- Cucumber Seaweed Salad
- Minted Garbanzo Bean Salad
- Vegetable Appetizer 2
- Vegetable Appetizer 4
- Garlic Dip with Crudites
- Tahini and Crudites

Safety

Cucumbers and Wax Coatings

As described above in our Healthiest Way of Preparing Cucumbers section, cucumbers (like other fragile vegetables) may be waxed to protect them from bruising during shipping. Both conventionally grown and organically grown cucumbers may be waxed. However, the only waxes that can be used on organically grown cucumbers are non-synthetic waxes, and these waxes must be free of all chemical contaminants that are prohibited under organic regulations. Conventionally grown cucumbers may be waxed with synthetic waxes that contain unwanted chemical contaminants. In addition, other compounds, including ethyl alcohol, milk casein, and soaps may be added to synthetic waxes for consistency, "film" formation, and improved flow of wax onto the cucumber. Individuals concerned about any of these factors would do best to purchase organically grown cucumbers.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Cucumber, sliced, raw
1.00 cup
104.00 grams

Calories: 16
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin K	17.06 mcg	19	21.9	excellent
molybdenum	5.20 mcg	12	13.3	excellent
pantothenic acid	0.27 mg	5	6.2	very good
copper	0.04 mg	4	5.1	good
potassium	152.88 mg	4	5.0	good
manganese	0.08 mg	4	4.6	good
vitamin C	2.91 mg	4	4.5	good
phosphorus	24.96 mg	4	4.1	good
magnesium	13.52 mg	3	3.9	good
biotin	0.94 mcg	3	3.6	good
vitamin B1	0.03 mg	3	2.9	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Eggplant

About Eggplant

Long prized for its deeply purple, glossy beauty as well as its unique taste and texture, eggplants are now available in markets throughout the year, but they are at their very best from August through October when they are in season.

Eggplants belong to the nightshade family of vegetables, which also includes tomatoes, bell peppers and potatoes. They grow in a manner much like tomatoes, hanging from the vines of a plant that grows several feet in height. While the different varieties do range slightly in taste and texture, one can generally describe the eggplant as having a pleasantly bitter taste and spongy texture.

Eggplant, cubed, cooked
1.00 cup
(99.00 grams)

Calories: 35
GI: low

Nutrient	DRI/DV
fiber	10%
copper	7%
vitamin B1	7%
manganese	6%
vitamin B6	5%
vitamin B3	4%
vitamin K	3%
potassium	3%
folate	3%

Health Benefits

In addition to featuring a host of vitamins and minerals, eggplant also contains important phytonutrients, many which have antioxidant activity. Phytonutrients contained in eggplant include phenolic compounds, such caffeic and chlorogenic acid, and flavonoids, such as *nasunin*.

Brain Food

Research on eggplant has focused on an anthocyanin phytonutrient found in eggplant skin called *nasunin*. Nasunin is a potent antioxidant and free radical scavenger that has been shown to protect cell membranes from damage. In animal studies, nasunin has been found to protect the lipids (fats) in brain cell membranes. Cell membranes are almost entirely composed of lipids and are responsible for protecting the cell from free radicals, letting nutrients in and wastes out, and receiving instructions from messenger molecules that tell the cell which activities it should perform.

Rich in Phenolic Antioxidant Compounds

Researchers at the US Agricultural Service in Beltsville, Maryland, have found that eggplants are rich sources of phenolic compounds that function as antioxidants. Plants form such compounds to protect themselves against oxidative stress from exposure to the elements, as well as from infection by bacteria and fungi.

The good news concerning eggplant is that the predominant phenolic compound found in all varieties tested is chlorogenic acid, which is one of the most potent free radical scavengers found in plant tissues. Benefits attributed to chlorogenic acid include antimutagenic (anti-cancer), antimicrobial, anti-LDL (bad cholesterol) and antiviral activities.

ARS researchers studied seven eggplant cultivars grown commercially in the U.S. and a diverse collection of exotic and wild eggplants from other counties. In addition to chlorogenic acid, they found 13 other phenolic acids present at significantly varying levels in the commercial cultivars, although chlorogenic acid was the predominant phenolic compound in all of them. Black Magic—a commercial eggplant cultivar representative of U.S. market types—was found to have nearly three times the amount of antioxidant phenolics as the other eggplant cultivars that were studied. In addition to their nutritive potential, the phenolic acids in eggplant are responsible for some eggplants' bitter taste and the browing that results when their flesh is cut.

An enzyme called polyphenol oxidase triggers a phenolic reaction that produces brown pigments. Scientists have begun work on developing eggplant cultivars with an optimal balance of phenolics to ensure both optimal nutritional value and pleasing taste.

Cardiovascular Health and Free Radical Protection

When laboratory animals with high cholesterol were given eggplant juice, their blood cholesterol, the cholesterol in their artery walls and the cholesterol in their aortas (the aorta is the artery that returns blood from the heart back into circulation into the body) was significantly reduced, while the walls of their blood vessels relaxed, improving blood flow. These positive effects were likely due not only to nasunin but also to several other terpene phytonutrients in eggplant.

Nasunin is not only a potent free-radical scavenger, but is also an iron chelator. Although iron is an essential nutrient and is necessary for oxygen transport, normal immune function and collagen synthesis, too much iron is not a good thing. Excess iron increases free radical production and is associated with an increased risk of heart disease and cancer. Menstruating women, who lose iron every month in their menstrual flow, are unlikely to be at risk, but in postmenopausal women and men, iron, which is not easily excreted, can accumulate. By chelating iron, nasunin lessens free radical formation with numerous beneficial results, including protecting blood cholesterol (which is also a type of lipid or fat) from peroxidation; preventing cellular damage that can promote cancer; and lessening free radical damage in joints, which is a primary factor in rheumatoid arthritis.

Description

Eggplant, or *aubergine* as it is called in France, is a vegetable long prized for its beauty as well as its unique taste and texture. Eggplants belong to the plant family of *Solanaceae*, also commonly known as nightshades, and are kin to the tomato, bell pepper and potato. Eggplants grow in a manner much like tomatoes, hanging from the vines of a plant that grows several feet in height.

One of the most popular varieties of eggplant in North America looks like a pear-shaped egg, a characteristic from which its name is derived. The skin is glossy and deep purple in color, while the flesh is cream colored and spongy in consistency. Contained within the flesh are seeds arranged in a conical pattern.

In addition to this variety, eggplant is also available in a cornucopia of other colors including lavender, jade green, orange, and yellow-white, as well as in sizes and shapes that range from that of a small tomato to a large zucchini.

While the different varieties do vary slightly in taste and texture, one can generally describe the eggplant as having a pleasantly bitter taste and spongy texture. In many recipes, eggplant fulfills the role of being a complementary ingredient that balances the surrounding flavors of the other more pronounced ingredients.

History

The ancient ancestors of eggplant grew wild in India and were first cultivated in China in the 5th century B.C. Eggplant was introduced to Africa before the Middle Ages and then into Italy, the country with which it has long been associated, in the 14th century. It subsequently spread throughout Europe and the Middle East and, centuries later, was brought to the Western Hemisphere by European explorers. Today, Italy, Turkey, Egypt, China and Japan are the leading growers of eggplant.

Although it has a long and rich history, eggplant did not always hold the revered place in food culture that it does today, especially in European cuisines. As a result of the overly bitter taste of the early varieties, it seems that people also felt that it had a bitter disposition—eggplant held the undeserved and inauspicious reputation of being able to cause insanity, leprosy and cancer.

For centuries after its introduction into Europe, eggplant was used more as a decorative garden plant than as a food. Not until new varieties were developed in the 18th century, did eggplant lose its bitter taste and bitter reputation, and take its now esteemed place in the cuisines of many European countries, including Italy, Greece, Turkey and France.

How to Select and Store

Choose eggplants that are firm and heavy for their size. Their skin should be smooth and shiny, and their color, whether it be purple, white or green, should be vivid. They should be free of discoloration, scars, and bruises, which usually indicate that the flesh beneath has become damaged and possibly decayed.

The stem and cap, on either end of the eggplant, should be bright green in color. As you would with other fruits and vegetables, avoid purchasing eggplant that has been waxed. To test for the ripeness of an eggplant, gently press the skin with the pad of your thumb. If it springs back, the eggplant is ripe, while if an indentation remains, it is not.

Although they look hardy, eggplants are actually very perishable and care should be taken in their storage. Eggplants are sensitive to both heat and cold and should ideally be stored at around 50 degrees Fahrenheit (10 degrees Celsius). Do not cut eggplant before you store it as it perishes quickly once its skin has been punctured or its inner flesh exposed.

Place uncut and unwashed eggplant in a plastic bag and store in the refrigerator crisper where it will keep for a few days. If it is too large for the crisper, do not try to force it in; this will damage the skin and cause the eggplant to spoil and decay. Instead, place it on a shelf within the refrigerator.

If you purchase eggplant that is wrapped in plastic film, remove it as soon as possible since it will inhibit the eggplant from breathing and degrade its freshness.

How to Enjoy

A Few Quick Serving Ideas

- For homemade babaganoush, purée roasted eggplant, garlic, tahini, lemon juice and olive oil.
- Use it as a dip for vegetables or as a sandwich filling.
- Mix cubed baked eggplant with grilled peppers, lentils, onions and garlic and top with balsamic vinaigrette.
- Stuff miniature Japanese eggplants with a mixture of feta cheese, pine nuts and roasted peppers.
- Add eggplant to your next Indian curry stir-fry.

Safety

Eggplant Belongs to the Nightshade Family

Eggplant is one of the vegetables that belong to the nightshade (Solanaceae) family. For helpful information about nightshade vegetables—including our WHFoods Recommendations—please see our article, Which foods are classified as "nightshades," and is it true that foods from this group can potentially contain problematic substances?

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Eggplant, cubed, cooked
1.00 cup
99.00 grams

Calories: 35
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
fiber	2.47 g	10	5.1	very good
vitamin B1	0.08 mg	7	3.5	very good
copper	0.06 mg	7	3.5	very good
manganese	0.11 mg	6	2.9	good
vitamin B6	0.09 mg	5	2.8	good
vitamin B3	0.59 mg	4	1.9	good
potassium	121.77 mg	3	1.8	good

folate	13.86 mcg	3	1.8	good
vitamin K	2.87 mcg	3	1.7	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Fennel

Fennel is crunchy and slightly sweet, adding a refreshing contribution to the ever popular Mediterranean cuisine. Most often associated with Italian cooking, be sure to add this to your selection of fresh vegetables from the autumn through early spring when it is readily available and at its best.

Fennel is composed of a white or pale green bulb from which closely superimposed stalks are arranged. The stalks are topped with feathery green leaves near which flowers grow and produce fennel seeds. The bulb, stalk, leaves and seeds are all edible. Fennel belongs to the Umbelliferae family and is therefore closely related to parsley, carrots, dill and coriander.

Fennel, sliced, raw
1.00 cup
(87.00 grams)

Calories: 27
GI: very low

Nutrient	DRI/DV
vitamin C	14%
fiber	11%
potassium	10%
molybdenum	10%
manganese	9%
copper	7%
folate	6%
phosphorus	6%
magnesium	4%
calcium	4%
iron	4%
vitamin B3	4%
pantothenic acid	4%

Health Benefits

Unique Phytonutrients with Antioxidant and Health-Promoting Effects

Like many of its fellow spices, fennel contains its own unique combination of phytonutrients—including the flavonoids *rutin*, *quercitin*, and various *kaempferol glycosides*—that give it strong antioxidant activity. The phytonutrients in fennel extracts compare favorably in research studies to BHT (*butylated hydroxytoluene*), a potentially toxic antioxidant commonly added to processed foods.

The most fascinating phytonutrient compound in fennel, however, may be *anethole*—the primary component of its volatile oil. In animal studies, the *anethole* in fennel has repeatedly been shown to reduce inflammation and to help prevent the occurrence of cancer. Researchers have also proposed a biological mechanism that may explain these anti-inflammatory and anticancer effects. This mechanism involves the shutting down of a intercellular signaling system called *tumor necrosis factor* (or *TNF*)-*mediated signaling*. By shutting down this signaling process, the *anethole* in fennel prevents activation of a potentially strong gene-altering and inflammation-triggering molecule called *NF-kappaB*. The volatile oil has also been shown to be able to protect the liver of experimental animals from toxic chemical injury.

Antioxidant Protection and Immune Support from Vitamin C

In addition to its unusual phytonutrients, fennel bulb is an excellent source of vitamin C. Vitamin C is the body's primary water-soluble antioxidant, able to neutralize free radicals in all aqueous environments of the body. If left unchecked, these free radicals cause cellular damage that results in the pain and joint deterioration that occurs in conditions like osteoarthritis and rheumatoid arthritis.

The vitamin C found in fennel bulb is directly antimicrobial and is also needed for the proper function of the immune system.

Fiber, Folate and Potassium for Cardiovascular and Colon Health

As a very good source of fiber, fennel bulb may help to reduce elevated cholesterol levels. And since fiber also removes potentially carcinogenic toxins from the colon, fennel bulb may also be useful in preventing colon cancer. In addition to its fiber, fennel is a very good source of folate, a B vitamin that is necessary for the conversion of a dangerous molecule called *homocysteine* into other, benign molecules. At high levels, homocysteine, which can directly damage blood vessel walls, is considered a significant risk factor for heart attack or stroke. Fennel is also a very good source of potassium, a mineral that helps lower high blood pressure, another risk factor for stroke and heart attack.

Description

Fennel is a versatile vegetable that plays an important role in the food culture of many European nations, especially in France and Italy. Its esteemed reputation dates back to the earliest times and is reflected in its mythological traditions. Greek myths state that fennel was not only closely associated with Dionysus, the Greek god of food and wine, but that a fennel stalk carried the coal that passed down knowledge from the gods to men.

Fennel is composed of a white or pale green bulb from which closely superimposed stalks are arranged. The stalks are topped with feathery green leaves near which flowers grow and produce fennel seeds. The bulb, stalk, leaves and seeds are all edible. Fennel belongs to the *Umbelliferea*e family and is therefore closely related to parsley, carrots, dill and coriander.

Fennel's aromatic taste is unique, strikingly reminiscent of licorice and anise, so much so that fennel is often mistakenly referred to as anise in the marketplace. Fennel's texture is similar to that of celery, having a crunchy and striated texture.

The scientific name for fennel is *Foeniculum vulgare*.

History

Ever since ancient times, fennel has enjoyed a rich history. The ancient Greeks knew fennel by the name "marathron"; it grew in the field in which one of the great ancient battles was fought and which was subsequently named the Battle of Marathon after this revered plant. Fennel was also awarded to Pheidippides, the runner who delivered the news of the Persian invasion to Sparta. Greek myths also hold that knowledge was delivered to man by the gods at Olympus in a fennel stalk filled with coal. Fennel was revered by the Greeks and the Romans for its medicinal and culinary properties.

Fennel has been grown throughout Europe, especially areas surrounding the Mediterranean Sea, and the Near East since ancient times. Today, the United States, France, India and Russia are among the leading cultivators of fennel.

How to Select and Store

Good quality fennel will have bulbs that are clean, firm and solid, without signs of splitting, bruising or spotting. The bulbs should be whitish or pale green in color. The stalks should be relatively straight and closely superimposed around the bulb and should not splay out to the sides too much. Both the stalks and the leaves should be green in color. There should be no signs of flowering buds as this indicates that the vegetable is past maturity. Fresh fennel should have a fragrant aroma, smelling subtly of licorice or anise. Fennel is usually available from autumn through early spring.

Store fresh fennel in the refrigerator crisper, where it should keep fresh for about four days. Loss of some nutrients in fennel—for example, its vitamin C content—is likely to be slowed down through refrigeration. Yet, it is best to consume fennel soon after purchase since as it ages, it tends to gradually lose its flavor. While fresh fennel can be frozen after first being blanched, it seems to lose much of its flavor during this process. Dried fennel seeds should be stored in an airtight container in a cool and dry location where they will keep for about six months. Storing fennel seeds in the refrigerator will help to keep them fresher longer.

How to Enjoy

A Few Quick Serving Ideas

- Healthy sautéed fennel and onions make a wonderful side dish.
- Combine sliced fennel with avocados, and oranges for a delightful salad.
- Braised fennel is a wonderful complement to scallops.
- Next time you are looking for a new way to adorn your sandwiches, consider adding sliced fennel in addition to the traditional toppings of lettuce and tomato.

- Top thinly sliced fennel with plain yogurt and mint leaves.
- Fennel is a match made in Heaven when served with salmon.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

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Fennel, sliced, raw
1.00 cup
87.00 grams

Calories: 27
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin C	10.44 mg	14	9.3	excellent
fiber	2.70 g	11	7.2	very good
potassium	360.18 mg	10	6.9	very good
molybdenum	4.35 mcg	10	6.5	very good
manganese	0.17 mg	9	5.7	very good
copper	0.06 mg	7	4.4	very good
phosphorus	43.50 mg	6	4.1	very good
folate	23.49 mcg	6	3.9	very good
calcium	42.63 mg	4	2.8	good
pantothenic acid	0.20 mg	4	2.7	good
magnesium	14.79 mg	4	2.5	good
iron	0.64 mg	4	2.4	good
vitamin B3	0.56 mg	4	2.3	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Garlic

What's New and Beneficial About Garlic

- One potential health benefit from garlic might be obtained by chopping or crushing it and letting it sit before heating it along with other recipe ingredients. Chopping will activate alliinase enzymes in some of the cells, and sitting will allow those enzymes to convert some of the garlic's allin into allicin. Both alliin and allicin are sulfur-compounds and while both provide health benefits, the health benefits of allicin are especially well-documented in research studies.
- Garlic may help improve your iron metabolism. That's because the diallyl sulfides in garlic can help increase production of a protein called ferroportin. (Ferroportin is a protein that runs across the cell membrane, and it forms a passageway that allows stored iron to leave the cells and become available where it is needed.)
- In addition to being a good source of selenium, garlic may be a more reliable source as well. Garlic is what scientists call a "seleniferous" plant: it can uptake selenium from the soil even when soil concentrations do not favor this uptake.
- The cardioprotective benefits of garlic may partly rest on the production of hydrogen sulfide (H2S) gas. Our red blood cells can take some types of sulfur-containing molecules in garlic (called polysulfides) and use them to produce H2S. This H2S in turn can help our blood vessels expand and keep our blood pressure in check. Interestingly, some processed garlic extracts cannot be used by our red blood cells in the same way and do not seem to provide the same level of cardioprotection that is provided by garlic in food form.
- While still in its very early stages, research suggests that garlic consumption may actually help to regulate the number of fat cells that get formed in our body. 1,2-DT (1,2-vinyldithiin) is one of the unique sulfur compounds in garlic that has long been recognized as having anti-inflammatory properties. But only recently have researchers discovered that some of our fibroblastic cells (called "preadipocytes") only evolve into full-fledged fat cells (called "adipocytes") under certain metabolic circumstances involving inflammatory system activity. 1,2-DT may be able to inhibit this conversion process. Since obesity is increasingly viewed by researchers as a chronic state of low-grade inflammation, the inflammation-related benefits of garlic's 1,2-DT may eventually be extended into the clinical area of obesity.

WHFoods Recommendations

With their unique combination of flavonoids and sulfur-containing nutrients, allium vegetables—such as garlic—belong in your diet on a regular basis. There's research evidence for including at least one serving of an allium vegetable—such as garlic—in your meal plan every day. If you're choosing garlic as your allium family vegetable, try to include at least 1/2 clove in your individual food portion. If you're preparing a recipe, we recommend at least 1-2 cloves.

Garlic is a wonderful seasoning to add aroma, taste, and added nutrition to your dishes. We often recommend using raw chopped or pressed garlic in many of our dishes to take advantage of the benefits derived from garlic. However, if you cannot tolerate raw garlic, you can add chopped garlic to foods while they are cooking. It is best to add it towards the end of the cooking process to retain the maximum amount of flavor and nutrition

Garlic, raw
6.00 cloves
(18.00 grams)

Calories: 27
GI: low

Nutrient	DRI/DV
manganese	15%
vitamin B6	13%
vitamin C	7%
copper	6%
selenium	5%
phosphorus	4%
calcium	3%
vitamin B1	3%

Health Benefits

Whole books have been written about garlic, an herb affectionately called "the stinking rose" in light of its numerous therapeutic benefits. A member of the lily or *Allium* family, which also includes onions and leeks, garlic is rich in a variety of powerful sulfur-containing compounds including *thiosulfinates* (an important example being *allicin*), *sulfoxides* (a well-studied example being *alliin*), *volatile organosulfur compounds*> like diallyl sulfides, *vinyldithiins*, *ajoene* and its derivatives, and also *water-soluble organosulfur compounds* (inclucing S-allyl-L-cysteine). Some of these compounds are largely responsible for garlic's characteristically pungent odor, and they are also the source of documented health benefits.

Fairly recent research has linked some of the less well-studied sulfur compounds in garlic to potential support of our cardiovascular health. These sulfur compounds include 1,2-vinyldithiin (1,2-DT), and thiacremonone. The hydrogen sulfide gas (H2S) that can be made from garlic's sulfides has also been the subject of great research interest. When produced and released from our red blood cells, this H2S gas can help dilate our blood vessels and help keep our blood pressure under control.

Finally, when thinking about the sulfur compounds in garlic, it is important to remember that sulfur itself is a key part of our health. Several research studies have noted that the average U.S. diet may be deficient in sulfur, and that foods rich in sulfur may be especially important for our health. In addition to all of the sulfur-related compounds listed above, garlic is an excellent source of manganese and vitamin B6, a very good source of vitamin C, and a good source of selenium.

Cardiovascular Benefits

Most of the research on garlic and our cardiovascular system has been conducted on garlic powder, garlic oil, or aged garlic extracts rather than garlic in food form. But despite this research limitation, food studies on garlic show this allium vegetable to have important cardioprotective properties. Garlic is clearly able to lower our blood triglycerides and total cholesterol, even though this reduction can be moderate (5-15%).

But cholesterol and triglyceride reduction are by no means garlic's most compelling benefits when it comes to cardioprotection. Those top-level benefits clearly come in the form of blood cell and blood vessel protection from inflammatory and oxidative stress. Damage to blood vessel linings by highly reactive oxygen molecules is a key factor for increasing our risk of cardiovascular problems, including heart attack and atherosclerosis. Oxidative damage also leads to unwanted inflammation, and it is this combination of unwanted inflammation and oxidative stress that puts our blood vessels at risk of unwanted plaque formation and clogging. Garlic unique set of sulfur-containing compounds helps protect us against both possibilities—oxidative stress and unwanted inflammation.

The following provides a list of sulfur-containing garlic's constituents that help lower our risk of oxidative stress:

- alliin
- allicin
- allixin
- allyl polysulfides (APS)*
- diallyl sulfide (DAS)
- diallyl disulfude (DADS)
- diallyl trisulfide (DATS)
- N-acetylcysteine (NAC)
- N-acetyl-S-allylcysteine (NASC)
- S-allylcysteine (SAC)
- S-allylmercaptocysteine (SAMC)
- S-ethylcysteine (SEC)
- S-methylcysteine (SMC)
- S-propylcysteine (SPC)
- 1,2-vinyldithiin (1,2-DT)
- thiacremonone

* "Allyl polysulfides" is a general term that refers to a variety of compounds.

On the anti-inflammatory side of the equation, garlic's 1,2-vinyldithiin (1,2-DT) and thiacremonone are the compounds that have been of special interest in recent research. Both compounds appear to work by inhibiting the activity of inflammatory messenger molecules. In the case of thiacremonone, it is the inflammatory transcription factor called NFkappaB that gets inhibited. In the case of 1,2-DT, the exact anti-inflammatory mechanisms are not yet clear, even though the release of inflammatory messaging molecules like interleukin 6 (IL-6) and interleukin 8 (IL-8) by macrophage cells has been shown to be reduced in white adipose tissue by 1,2-DT. The combination of anti-inflammatory and anti-oxidative stress compounds in garlic makes it a unique food for cardiovascular support, especially in terms of chronic degenerative cardiovascular conditions like atherosclerosis.

In addition to the ability of garlic to help prevent our blood vessels from becoming blocked, this allium vegetable may also be able to help prevent clots from forming inside of our blood vessels. This cardiovascular protection has been linked to one particular disulfide in garlic called ajoene. Ajoene has repeatedly been shown to have anti-clotting properties. It can help prevent certain cells in our blood (called platelets) from becoming too sticky, and by keeping this stickiness in check, it lowers the risk of our platelets clumping together and forming a clot.

Equally impressive about garlic is its ability to lower blood pressure. Researchers have known for about 10 years that the allicin made from alliin in garlic blocks the activity of angiotensin II. A small piece of protein (peptide), angiotensin II helps our blood vessels contract. (When they contract, our blood is forced to pass through a smaller space, and the pressure is increased.) By blocking the activity of angiotensin II, allicin form garlic is able to help prevent unwanted contraction of our blood vessels and unwanted increases in blood pressure.

More recently, however, researchers have found that garlic supports our blood pressure in a second and totally different way. Garlic is rich in sulfur-containing molecules called polysulfides. It turns out that these polysulfides, once inside our red blood cells (RBCs), can be further converted by our RBCs into a gas called hydrogen sulfide (H2S). H2S helps control our blood pressure by triggering dilation of our blood vessels. When the space inside our blood vessels expands, our blood pressure gets reduced. (H2S is described as a "gasotransmitter" and placed in the same category as nitric oxide (NO) as a messaging molecule that can help expand and relax our blood vessel walls.) Interestingly, our RBCs do not appear to use processed garlic extracts in the same way that they use polysulfides in food-form garlic.

Garlic's numerous beneficial cardiovascular effects are due to not only its sulfur compounds, but also to its vitamin C, vitamin B6, selenium and manganese. Garlic is a very good source of vitamin C, the body's primary antioxidant defender in all aqueous (water-soluble) areas, such as the bloodstream, where it protects LDL cholesterol from oxidation. Since it is the oxidized form of LDL cholesterol that initiates damage to blood vessel walls, reducing levels of oxidizing free radicals in the bloodstream can have a profound effect on preventing cardiovascular disease.

Garlic's vitamin B6 helps prevent heart disease via another mechanism: lowering levels of homocysteine. An intermediate product of an important cellular biochemical process called the methylation cycle, homocysteine can directly damage blood vessel walls.

The selenium in garlic can become an important part of our body's antioxidant system. A cofactor of *glutathione peroxidase* (one of the body's most important internally produced antioxidant enzymes), selenium also works with vitamin E in a number of vital antioxidant systems.

Garlic is rich not only in selenium, but also in another trace mineral, manganese, which also functions as a cofactor in a number of other important antioxidant defense enzymes, for example, *superoxide dismutase*. Studies have found that in adults deficient in manganese, the level of HDL (the "good form" of cholesterol) is decreased.

Anti-Inflammatory Benefits Across Body Systems

Our cardiovascular system is not the only body system that may be able to benefit from garlic's anti-inflammatory properties. There's preliminary evidence (mostly from animal studies, and mostly based on garlic extracts rather than whole food garlic) that our our musculoskeletal system and respiratory system can also benefit from anti-inflammatory compounds in garlic. Both the diallyl sulfide (DAS) and thiacremonone in garlic have been shown to have anti-arthritic properties. And in the case of allergic airway inflammation, aged garlic extract has been show to improve inflammatory conditions (once again in animal studies).

Even more preliminary is research evidence showing that some inflammatory aspects of obesity may be altered by sulfur-containing compounds in garlic. Specifically, there is one stage in development of the body's fat cells (adipocytes) that appears to be closely related to status of our inflammatory system. Fat cells cannot become fully themselves unless they are able to progress from a preliminary stage called "preadipocytes" to a final stage called "adipocytes." One of the sulfur compounds in garlic (1,2,-vinyldithiin, or 1,2-DT) appears able to lessen this conversion of preadipocytes into adipocytes, and the impact of 1,2-DT appears to be inflammation-related. Even though very preliminary, this research on 1,2-DT is exciting because obesity is increasingly being understood as a disease characterized by chronic, low level inflammation and our inflammatory status is precisely where garlic's 1,2-DT has its apparent impact.

Antibacterial and Antiviral Benefits

From a medical history standpoint, the antibacterial and antiviral properties of garlic are perhaps its most legendary feature. This allium vegetable and its constituents have been studied not only for their benefits in controlling infection by bacteria and viruses, but also infection from other microbes including yeasts/fungi and worms. (One particular disulfide in garlic, called ajoene, has been successfully used to help prevent infections with the yeast *Candida albicans*.) Very recent research has shown the ability of crushed fresh garlic to help prevent infection by the bacterium *Pseudomonas aeruginosa* in burn patients. Also of special interest has been the ability of garlic to help in the treatment of bacterial infections that are difficult to treat due to the presence of bacteria that have become resistant to prescription antibiotics. However, most of the research on garlic as an antibiotic has involved fresh garlic extracts or powdered garlic products rather than fresh garlic in whole food form.

Overgrowth of the bacterium *Helicobacter pylori* in the stomach—a key risk factor for stomach ulcer—has been another key area of interest for researchers wanting to explore garlic's antibacterial benefits. Results in this area, however, have been mixed and inconclusive. While garlic may not be able to alter the course of infection itself, there may still be health benefits from garlic in helping to regulate the body's response to that infection.

Cancer Prevention

While not as strong as the research evidence for cruciferous vegetables, research on the allium vegetables—including garlic—shows that these vegetables have important anti-cancer properties. Interestingly, high intake of garlic (roughly translated as daily intake of this food) has been found to lower risk of virtually all cancer types except cancer of the prostate and breast cancer. However, moderate intake of garlic (roughly translated as several times per week) has been repeatedly found to lower risk of only two cancer types—colorectal and renal cancer. This difference between "high" versus "moderate" garlic intake may be a real difference that suggests we all need to eat more garlic if we want to maximize its cancer-related benefits. Or it may be a difference that is more related to research complications involving the options given to research participants when reporting their food intake. Still, garlic has a consistent track record with respect to general anti-cancer benefits, and there are good research reasons for classifying garlic as an "anti-cancer" food.

The allyl sulfides found in garlic may play a key role in its cancer-prevention benefits. These garlic compounds are able to activate a molecule called nuclear erythroid factor (Nrf2) in the main compartment of cells. The Nrf2 molecule then moves from the main compartment of the cell into the cell nucleus, where it triggers a wide variety of metabolic activities. Under some circumstances, this set of events can prepare a cell for engagement in a strong survival response, and in particular, the kind of response that is needed under conditions of oxidative stress. Under other circumstances, this same set of events can prepare the cell to engage in programmed cell death (apoptosis). When a cell recognizes that it has become too compromised to continue functioning in a healthy manner with other cells, it stops proceeding through its own life cycle and essentially starts to dismantle itself and recycle its parts. It's critical for a cell to determine whether it should continue on or shut itself down, because cells that continue on without the ability to properly function or communicate effectively with other cells are at risk of becoming cancerous. The ability of garlic's allyl sulfides to activate Nrf2 suggests that garlic may be able to help modify these all-critical cell responses and prevent potentially cancerous cells from forming.

One especially interesting area of research on garlic and cancer prevention involves meat cooked at high temperatures. Heterocyclic amines (HCAs) are cancer-related substances that can form when meat comes into contact with a high-temperature cooking surface (400°F/204°C or higher). One such HCA is called PhIP (which stands for 2-amino-1-methyl-6-phenylimidazopyridine). PhIP is thought to be one reason for the increased incidence of breast cancer among women who eat large quantities of meat because it is rapidly transformed into DNA-damaging compounds.

Diallyl sulfide (DAS), one of the many sulfur-containing compounds in garlic, has been shown to inhibit the transformation of PhIP into carcinogens. DAS blocks this transformation by decreasing the production of the liver enzymes (the Phase I enzymes CYP1A1, CYP1A2 and CYP1B1) that transform PhIP into activated DNA-damaging compounds. Of course, your best way to prevent formation of PhIP is not to bring your meat into contact with a 400°F/204°C cooking surface in the first place. But this area of research still bolsters our view of garlic as an allium vegetable with important cancer-preventive properties.

Garlic and Iron Metabolism

Recent research has shown that garlic may be able to improve our metabolism of iron. When iron is stored up in our cells, one of the key passageways for it to be moved out of the cell and returned into circulation involves a protein called ferroportin. Ferroportin is protein that runs across the cell membrane, and it provides a bridge for iron to cross over and leave the cell. Garlic may be able to increase our body's production of ferroportin, and in this way, help keep iron in circulation as it is needed.

Description

For a small vegetable, garlic (*Allium sativum*) sure has a big, and well deserved, reputation. And although garlic may not always bring good luck, protect against evil, or ward off vampires, characteristics to which it has been assigned folklorically, it is guaranteed to transform any meal into a bold, aromatic, and healthy culinary experience. Garlic is a member of the Lily family and is a cousin to onions, leeks and chives.

Garlic is arranged in a head, called a "bulb," which averages about 2 inches in height and diameter and consists of numerous small separate cloves. Both the cloves and the entire bulb are encased in paper-like sheathes that can be white, off-white, or have a pink/purple hue. Although garlic cloves have a firm texture, they can be easily cut or crushed. The taste of garlic is like no other—it hits the palate with a hot pungency that is shadowed by a very subtle background sweetness. While elephant garlic has larger cloves, it is more closely related to the leek and therefore does not offer the full health benefits of regular garlic.

Fresh, dried and powdered garlic are available in markets throughout the year, however, fresh varieties from California are in season from June through December.

History

Native to central Asia, garlic is one of the oldest cultivated plants in the world and has been grown for over 5000 years. Ancient Egyptians seem to have been the first to cultivate this plant that played an important role in their culture.

Garlic was not only bestowed with sacred qualities and placed in the tomb of Pharaohs, but it was given to the slaves that built the Pyramids to enhance their endurance and strength. This strength-enhancing quality was also honored by the ancient Greeks and Romans, civilizations whose athletes ate garlic before sporting events and whose soldiers consumed it before going off to war.

Garlic was introduced into various regions throughout the globe by migrating cultural tribes and explorers. By the 6th century BC, garlic was known in both China and India, the latter country using it for therapeutic purposes.

Throughout the millennia, garlic has been a beloved plant in many cultures for both its culinary and medicinal properties. Over the last few years, it has gained unprecedented popularity since researchers have been scientifically validating its numerous health benefits.

Currently, China, South Korea, India, Spain and the United States are among the top commercial producers of garlic.

How to Select and Store

For maximum flavor and nutritional benefits, always purchase fresh garlic. Although garlic in flake, powder, or paste form may be more convenient, you will derive less culinary and health benefits from these forms.

Purchase garlic that is plump and has unbroken skin. Gently squeeze the garlic bulb between your fingers to check that it feels firm and is not damp.

Avoid garlic that is soft, shriveled, and moldy or that has begun to sprout. These may be indications of decay that will cause inferior flavor and texture. Size is often not an indication of quality. If your recipe calls for a large amount of garlic, remember that it is always easier to peel and chop a few larger cloves than many smaller ones. Fresh garlic is available in the market throughout the year.

Store fresh garlic in either an uncovered or a loosely covered container in a cool, dark place away from exposure to heat and sunlight. This will help maintain its maximum freshness and help prevent sprouting, which reduces its flavor and causes excess waste. It is not necessary to refrigerate garlic. Some people freeze peeled garlic; however, this process reduces its flavor profile and changes its texture.

Depending upon its age and variety, whole garlic bulbs will keep fresh for about a month if stored properly. Inspect the bulb frequently and remove any cloves that appear to be dried out or moldy. Once you break the head of garlic, it greatly reduces its shelf life to just a few days.

How to Enjoy

WHFoods Recipes That Feature Garlic

- Garlic Shrimp Salad
- Mediterranean Dressing

We actually include garlic as an ingredient in so many of our recipes. To find these just go to the Recipe Assistant on the Recipes page and click on "garlic" in the "Food to Include" box.

A Few Quick Serving Ideas

- Purée fresh garlic, canned garbanzo beans, tahini, olive oil and lemon juice to make quick and easy hummus dip.
- Healthy Sauté steamed spinach, garlic, and fresh lemon juice.
- Add garlic to sauces and soups.
- Purée roasted garlic, cooked potatoes and olive oil together to make delicious garlic mashed potatoes. Season to taste.

Safety

The Johns Hopkins Lupus Center has recently listed garlic as a food to be avoided by persons diagnosed with lupus (systemic lupus erythematosus, or SLE). While we have not seen any published research documenting lupus flare-ups with garlic intake, and while the Lupus Foundation of America has suggested on its website that "occasional use is cooking is not likely to cause significant problems for most people," we have heard directly from website visitors who have experienced problems in this area. If you are a person diagnosed with lupus, we recommend a consult with your healthcare provider to decide about inclusion or avoidance of garlic in your meal plan.

Do not store garlic in oil at room temperature. Garlic-in-oil mixtures stored at room temperature provide perfect conditions for producing botulism, regardless of whether the garlic is fresh or has been roasted.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Garlic, raw
6.00 cloves
18.00 grams

Calories: 27
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
manganese	0.30 mg	15	10.1	excellent
vitamin B6	0.22 mg	13	8.7	excellent
vitamin C	5.62 mg	7	5.0	very good
copper	0.05 mg	6	3.7	very good
selenium	2.56 mcg	5	3.1	good
phosphorus	27.54 mg	4	2.6	good
vitamin B1	0.04 mg	3	2.2	good
calcium	32.58 mg	3	2.2	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Green beans

Green Beans are the Food of the Week

This week we celebrate green beans, one of only a few varieties of beans that can be eaten fresh. Picked when they are still immature and the inner bean is just beginning to form green beans are a great source of folate, fiber and vitamin K.

For more on the Food of the Week

- >Cutting Green Beans
- Why is the food of the week among the WHFoods?"
- Healthy Eating with the Seasons

What's New and Beneficial about Green Beans

- Because of their rich green color, we don't always think about green beans as providing us with important amounts of colorful pigments like carotenoids. But they do! Recent studies have confirmed the presence of lutein, beta-carotene, violaxanthin, and neoxanthin in green beans. In some cases, the presence of these carotenoids in green beans is comparable to their presence in other carotenoid-rich vegetables like carrots and tomatoes. The only reason we don't see these carotenoids is because of the concentrated chlorophyll content of green beans and the amazing shades of green that it provides.
- You can enjoy green beans while supporting food sustainability! Recent surveys have shown that 60% of all commercially grown green beans are produced in the United States, with large amounts of green bean acreage found in the states of Illinois, Michigan, New York, Oregon, and Wisconsin. Although countries like France, Mexico, Iraq, and Argentina are large-scale producers of green beans, there is plenty of this delicious vegetable available in our own backyard.
- If you are unable to obtain fresh green beans, you can still get many valuable nutrients from green beans that have been frozen or canned. We like fresh greens the best! But we realize that access to them can sometimes be a problem. When first frozen and then cooked, retention of some B vitamins in green beans (like vitamins B6 and B2) can be as high as 90%. Recent studies have shown that canned green beans, on average, lose about one third of their phenolic compounds during the canning process. They lose B vitamins as well but in the case of some B vitamins like folic acid, as little as 10%.
- Green beans (referred to as "string beans" by the study authors) have recently been shown to have impressive antioxidant capacity. Research comparing the overall antioxidant capacity of green beans to other foods in the pea and bean families (for example, snow peas or winged beans) has found green beans to come out on top, even though green beans are not always highest in their concentration of specific antioxidant nutrients like phenolic acids or vitamin C. It's not surprising to find recent studies highlighting the antioxidant capacity of green beans! Researchers now know that the list of antioxidant flavonoids found in green beans is not limited to quercetin and kaemferol but also includes flavonoids like catechins, epicatechins, and procyanidins. Researchers also know that the antioxidant carotenoids in this vegetable are diverse, and include lutein, beta-carotene, violaxanthin, and neoxanthin, as noted above.
- Green beans may be a particularly helpful food for providing us with the mineral silicon. This mineral—while less well known than minerals like calcium and magnesium—is very important for bone health and for healthy formation of connective tissue. Green beans have recently been shown to stack up quite well against other commonly-eaten foods as a good source of absorbable silicon.

WHFoods Recommendations

To retain the maximum number of health-promoting phytonutrients and vitamins and minerals found in green beans, we recommend Healthy Steaming them for just 5 minutes. This also brings out their peak flavor and provides the moisture necessary to make them tender, and retain their beautifully bright green color. It is best to cook green beans whole to ensure even cooking. For more on the Healthiest Way of Cooking Green Beans, see below.

Green Beans, cooked **1.00 cup** **(125.00 grams)**	**Calories: 44** **GI: very low**
Nutrient	**DRI/DV**

vitamin K	22%
manganese	18%
fiber	16%
vitamin C	16%
folate	10%
vitamin B2	9%
copper	8%
vitamin B1	8%
magnesium	6%
chromium	6%
calcium	6%
iron	5%
phosphorus	5%
vitamin A	5%
omega-3 fats	5%
potassium	5%
choline	5%
protein	5%
vitamin B3	5%
vitamin B6	4%
vitamin E	4%

Health Benefits

Antioxidant Support from Green Beans

Best studied from a research standpoint is the antioxidant content of green beans. In addition to conventional antioxidant nutrients like vitamin C and beta-carotene, green beans contain important amounts of the antioxidant mineral manganese. But the area of phytonutrients is where green beans really shine through in their antioxidant value. Green beans contain a wide variety of carotenoids (including lutein, beta-carotene, violaxanthin, and neoxanthin) and flavonoids (including quercetin, kaemferol, catechins, epicatechins, and procyanidins) that have all been shown to have health-supportive antioxidant properties. In addition, the overall antioxidant capacity of green beans has been measured in several research studies, and in one study, green beans have been shown to have greater overall antioxidant capacity than similar foods in the pea and bean families, for example, snow peas or winged beans.

Cardiovascular Benefits

Just as you might expect, the antioxidant support provided by green beans provides us with some direct cardiovascular benefits. While most of the cardio research on green beans involves animal studies on rats and nice, improvement in levels of blood fats and better protection of these fats from oxygen damage has been shown to result from green bean intake. Interestingly, the green bean pod (the main portion of the green beans that provides the covering for the beans inside) appears to be more closely related to these cardio benefits than the young, immature beans that are found inside.

While not documented in the health research to date, we believe that the omega-3 fatty acid of content of green beans can also make an important contribution to their cardiovascular benefits. Most people do not even recognize green beans as a source of omega-3 fats! While there is a relatively small amount of the omega-3 fatty acid alpha-linolenic acid (ALA) in green beans, this amount can still be very important and is actually fairly large in comparison to the amount of calories in green beans. You get 1 milligram of ALA for every 4 calories of green beans that you eat. For every 4 calories of walnuts that you eat, you get 1.4 milligrams of ALA. So you can see that green beans—while not as concentrated in ALA as walnuts—are nevertheless an underrated source of this heart-protective nutrient.

Other Health Benefits

The strong carotenoid and flavonoid content of green beans also appears to give this vegetable some potentially unique anti-inflammatory benefits. For example, some very preliminary research in laboratory animals shows decreased activity of certain inflammation-related enzymes—lipoxygenases (LOX) and cyclooxygenases (COX)—following intake of bean extracts. Because type 2 diabetes is a health problem that is known to contain a basic component of chronic, unwanted inflammation, we are also not surprised to see some very preliminary research in the area of green bean intake, anti-inflammatory benefits, and prevention of type 2 diabetes. (The very good fiber content of green beans most likely adds to the potential of green beans to help prevent this common health problem.) We expect to see more research in both of these health benefit areas (anti-inflammatory benefits and prevention of type 2 diabetes).

Description

Commonly referred to as string beans, the string that once was their trademark (running lengthwise down the seam of the pod) can seldom be found in modern varieties. It's for this reason (the breeding out of the "string") that string beans are often referred to as "snap beans." Because they are picked at a younger, immature stage, "snap beans" can literally be snapped in half with a simple twist of the fingers. Although these bright green and crunchy beans are available at your local market throughout the year, they are in season from summer through early fall when they are at their best and the least expensive. You may also see them referred to as "*haricot vert*"—this term simply means "green bean" in French and is the common French term for this vegetable. This term can also refer to specific varieties of green beans that are popular in French cuisine because of their very thin shape and very tender texture

Green beans belong to the same family as shell beans, such as pinto beans, black beans, and kidney beans. In fact, all of these beans have the exact same genus/species name in science—*Phaseolus vulgaris*—and all can be referred to simply as "common beans." However, since green beans are usually picked while still immature and while the inner beans are just beginning to form in the pod, they are typically eaten in fresh (versus dried) form, pod and all. Green beans are often deep emerald green in color and come to a slight point at either end. Green bean varieties of this common bean family are usually selected for their great texture and flavor while still young and fresh on the vine. In contrast, dried bean varieties like pinto or black or kidney beans are usually selected for their ability to produce larger and more dense beans during the full time period when they mature on the vine. At full maturity, their pods are often too thick and fibrous to be readily enjoyed in fresh form, but the beans inside their pods are perfect for drying and storing.

History

Green beans and other beans, such are kidney beans, navy beans and black beans are all known scientifically as *Phaseolus vulgaris*. They are all referred to as "common beans," probably owing to the fact that they all derived from a common bean ancestor that originated in Peru. From there, they spread throughout South and Central America by migrating Indian tribes. They were introduced into Europe around the 16th century by Spanish explorers returning from their voyages to the New World, and subsequently were spread through many other parts of the world by Spanish and Portuguese traders. Today, the largest commercial producers of fresh green beans include Argentina, China, Egypt, France, Indonesia, India, Iraq, Italy, France, Mexico, the Netherlands, Spain, and the United States.

How to Select and Store

If possible, purchase green beans at a store or farmer's market that sells them loose so that you can sort through them to choose the beans of best quality. Purchase beans that have a smooth feel and a vibrant green color, and that are free from brown spots or bruises. They should have a firm texture and "snap" when broken.

Store unwashed fresh beans pods in a plastic bag kept in the refrigerator crisper. Loss of some nutrients in green beans—for example, its vitamin C content—is likely to be slowed down through refrigeration. Whole beans stored this way should keep for about seven days.

Many people wonder about the possibility of freezing green beans, or purchasing green beans that have already been frozen. Both options can work—green beans are definitely a vegetable that can be frozen. We've seen several research studies on the nutritional consequences of freezing green beans, and most studies show the ability of green beans to retain valuable amounts of nutrients for 3-6 months after freezing. If you don't have fresh green beans available on a year-round basis, purchasing frozen green beans can definitely provide you with a nutritionally valuable option.

If you wish to freeze green beans we recommend that you steam the green beans for 2-3 minutes. Remove from heat and let them cool thoroughly before placing them in freezer bags and storing them in your freezer.

It is good to remember that the passage of time appears to lessen the concentration of multiple nutrients. There appears to be less nutrient loss at 3 months than at 6 months, and you may want to limit your freezer storage of green beans (whether frozen at home or pre-purchased in frozen form) to about 3 months for this reason.

How to Enjoy

A Few Quick Serving Ideas

- Green beans are a classic ingredient in Salad Nicoise, a French cold salad dish that combines steamed green beans with tuna fish and potatoes.
- Healthy sauté green beans with shiitake mushrooms.
- Prepare the perennial favorite, green beans almondine, by sprinkling slivered almonds on healthy sautéed beans.

WHFoods Recipes That Feature Green Beans

- Marinated Bean Salad
- 5 Spice Chicken
- 5-Minute Green Beans
- Fennel Green Beans

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Green Beans, cooked
1.00 cup
125.00 grams

Calories: 44
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin K	20.00 mcg	22	9.1	excellent
manganese	0.36 mg	18	7.4	very good
vitamin C	12.13 mg	16	6.7	very good
fiber	4.00 g	16	6.6	very good
folate	41.25 mcg	10	4.2	very good
vitamin B2	0.12 mg	9	3.8	very good
copper	0.07 mg	8	3.2	good
vitamin B1	0.09 mg	8	3.1	good
chromium	2.04 mcg	6	2.4	good
magnesium	22.50 mg	6	2.3	good
calcium	55.00 mg	6	2.3	good
potassium	182.50 mg	5	2.1	good
phosphorus	36.25 mg	5	2.1	good
choline	21.13 mg	5	2.0	good
vitamin A	43.75 mcg RAE	5	2.0	good
vitamin B3	0.77 mg	5	2.0	good
protein	2.36 g	5	1.9	good
omega-3 fats	0.11 g	5	1.9	good
iron	0.81 mg	5	1.9	good
vitamin B6	0.07 mg	4	1.7	good
vitamin E	0.56 mg (ATE)	4	1.5	good

World's Healthiest	

Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Green peas

Green Peas are Our Food of the Week

This week we celebrate green peas, a favorite spring vegetable now in the peak of its season. It is the time when they have the best flavor and are usually the least expensive.. Green peas are a great addition to your menu because in addition to their concentration of vitamins and minerals, they also provide the carotenoid phytonutrients, *lutein* and *zeaxanthin*, which are known to promote vision and eye health.

- Learn How to Add Green Pes to YourHealthiest Way of Eating Step-by-Step:: Blending/Scraping Pureed Food (beans, peas, tofu)
- Why is the food of the week among the WHFoods?
- Healthy Eating with the Seasons

What's New and Beneficial about Green Peas

- We don't usually think about green peas as an exotic food in terms of nutrient composition—but we should. Because of their sweet taste and starchy texture, we know that green peas must contain some sugar and starch (and they do). But they also contain a unique assortment of health-protective phytonutrients. One of these phytonutrients—a polyphenol called coumestrol--has recently come to the forefront of research with respect to stomach cancer protection. A Mexico City-based study has shown that daily consumption of green peas along with other legumes lowers risk of stomach cancer (gastric cancer), especially when daily coumestrol intake from these legumes is approximately 2 milligrams or higher. Since one cup of green peas contains at least 10 milligrams of coumestrol, it's not difficult for us to obtain this remarkable health benefit.
- The unique phytonutrients in green peas also provide us with key antioxidant and anti-inflammatory benefits. Included in these phytonutrients are some recently-discovered green pea phytonutrients called saponins. Due to their almost exclusive appearance in peas, these phytonutrients actually contain the scientific word for peas (*Pisum*) in their names: pisumsaponins I and II, and pisomosides A and B. When coupled with other phytonutrients in green peas—including phenolic acids like ferulic and caffeic acid, and flavanols like catechin and epicatechin—the combined impact on our health may be far-reaching. For example, some researchers have now speculated that the association between green pea and legume intake and lowered risk of type 2 diabetes may be connected not only with the relatively low glycemic index of green peas (about 45-50) and their strong fiber and protein content, but also with this unusual combination of antioxidant and anti-inflammatory phytonutrients.
- Green peas stand out as an environmentally friendly food. Agricultural research has shown that pea crops can provide the soil with important benefits. First, peas belong to a category of crops called "nitrogen fixing" crops. With the help of bacteria in the soil, peas and other pulse crops are able to take nitrogen gas from the air and convert it into more complex and usable forms. This process increases nitrogen available in the soil without the need for added fertilizer. Peas also have a relatively shallow root system which can help prevent erosion of the soil, and once the peas have been picked, the plant remainders tend to break down relatively easily for soil replenishment. Finally, rotation of peas with other crops has been shown to lower the risk of pest problems. These environmentally friendly aspects of pea production add to their desirability as a regular part of our diet.
- Even though green peas are an extremely low-fat food (with approximately one-third gram of total fat per cup) the type of fat and fat-soluble nutrients they contain is impressive. Recent research has shown that green peas are a reliable source of omega-3 fats in the form of alpha-linolenic acid (ALA). In one cup of green peas, you can expect to find about 30 milligrams of ALA. About 130 milligrams of the essential omega-6 fatty acid, linoleic acid, can also be found in a cup of green peas. This very small but high-quality fat content of green peas helps provide us with important fat-soluble nutrients from this legume, including sizable amounts of beta-carotene and small but valuable amounts of vitamin E.

WHFoods Recommendations

Many public health organizations—including the American Diabetes Association, the American Heart Association, and the American Cancer Society—recommend legumes as a key food group for preventing disease and optimizing health. The 2005 Dietary Guidelines for Americans developed by the U.S. Department of Health and Human Services (USDHHS) and the U.S. Department of Agriculture (USDA) recommends 3 cups of legumes per week (based on a daily intake of approximately 2,000 calories). Because 1 serving of legumes was defined as 1/2 cup (cooked), the Dietary Guidelines for Americans come very close to recommending of 1/2 cup of cooked legumes on a daily basis. Based on our own research review, we believe that 3 cups of legumes per week is a very reasonable goal for support of good health. However, we also believe that optimal health benefits from legumes may require consumption of legumes in greater amounts. These greater amounts are based on studies in which legumes have been consumed at least 4 days per week and in amounts falling into a 1-2 cup range per day. These studies suggest a higher optimal health benefit level than the 2005 Dietary Guidelines: instead of 3 cups of weekly legumes, 4-8 cups would become the goal range. Remember that any amount of legumes is going to make a helpful addition to your diet. And whatever weekly level of legumes you decide to target, we definitely recommend inclusion of green peas among your legume choices.

Green Peas, cooked
1.00 cup
(137.75 grams)

Calories: 116
GI: low

Nutrient	DRI/DV
vitamin K	40%
manganese	36%
vitamin B1	30%
fiber	30%
copper	27%
vitamin C	26%
phosphorus	23%
folate	22%
vitamin B6	18%
vitamin B3	17%
vitamin B2	16%
protein	15%
zinc	15%
molybdenum	15%
magnesium	13%
iron	12%
potassium	11%
choline	10%

Health Benefits

Given their exceptionally strong nutrient composition, we've been surprised at the relatively small amount of research specifically focused on green peas as a health-supporting food. Green peas have been largely overlooked in research studies on legumes, which have tended to concentrate only on beans. In studies where the health benefits of green peas have been directly examined, it's usually been in their dried versus fresh form. These research trends are ones that we would really like to see reversed! Due to the lack of wide-scale health research on green peas, many of the connections that we would expect to see need further research substantiation. Despite the lack of studies directly linking green pea intake to improved health, we believe that the outstanding nutrient composition of green peas will eventually be shown to have far-reaching health benefits, extending well beyond the ones presented in this Health Benefits section.

Antioxidant and Anti-Inflammatory Benefits

If you have traditionally thought about green peas as a "starchy vegetable" that cannot provide you with very much in the way of phytonutrients or body systems support, it's time that you change your thinking. Green peas are loaded with antioxidants and anti-inflammatory nutrients, and these health-supportive nutrients are provided in a wide range of nutrient categories. For example, in the flavonoid category, green peas provide us with the antioxidants catechin and epicatechin. In the carotenoid category, they offer alpha-carotene and beta-carotene. Their phenolic acids include ferulic and caffeic acid. Their polyphenols include coumestrol. Pisumsaponins I and II and pisomosides A and B are anti-inflammatory phytonutrients found almost exclusively in peas. Antioxidant vitamins provided by green peas include vitamin C and vitamin E, and a good amount of the antioxidant mineral zinc is also found in this amazing food. Yet another key anti-inflammatory nutrient needs to be added to this list, and that nutrient is omega-3 fat. Recent research has shown that green peas are a reliable source of omega-3 fat in the form of alpha-linolenic acid (ALA). In one cup of green peas, you can expect to find about 30 milligrams of ALA.

Ordinarily, we would expect this extraordinary list of antioxidant and anti-inflammatory nutrients to be associated with lower risk of most inflammatory diseases, including heart disease, type 2 diabetes, and arthritis. Although large-scale studies on green pea intake and these chronic health problems remain unavailable, researchers have already begun to suggest connections in this area, particularly with respect to type 2 diabetes. We know that chronic, unwanted inflammation and chronic, unwanted oxidative stress increase our risk of type 2 diabetes. We also know that intake of green peas is associated with lowered risk of type 2 diabetes, even though this association has traditionally been understood to involve the strong fiber and protein content of green peas. Researchers now believe that the antioxidant and anti-inflammatory nutrients in greens peas play an equally important role in lowering our risk of this chronic health problem.

Support for Blood Sugar Regulation

As mentioned in the previous section, blood sugar regulation has been an area of special interest with respect to green peas and its fellow legumes. Few foods provide us with such substantial amounts of protein or fiber (about 8-10 grams per cup for each of these macronutrients) as green peas. These outstanding fiber and protein amounts directly regulate the pace at which we digest our food. By helping to regulate the pace of digestion, protein and fiber also help regulate the break down of starches into sugars and the general passage of carbs through out digestive tract. With better regulation of carbs, our blood sugar levels can stay steadier.

Recent research has greatly expanded our understanding of these health benefits. What we now know is that green peas and other pulses can help us lower our fasting blood sugar as well as our fasting insulin levels. Our long-term control of blood sugar (as measured by lab testing of glycosylated hemoblobin and fructosamine) is also improved by intake of green peas. When combined with an overall high-fiber diet, these benefits are increased. They are also increased when green peas are consumed as part of an overall diet that is low in glycemic index.

The outstanding antioxidant and anti-inflammatory nutrient composition of green peas are very likely to play a role in these blood sugar benefits. Regular consumption of antioxidant nutrients can help us prevent chronic, unwanted oxidative stress, while regular consumption of anti-inflammatory nutrients can help us prevent chronic, unwanted inflammation. Chronic inflammation and chronic oxidative stress are well-established risk factors for type 2 diabetes. Lowering our risk in these two areas is very likely to be one of the mechanisms involved with the diabetes-preventing benefits of green peas.

Heart Health Promotion

An area we expected to find well-documented health benefits from green peas is the area of cardiovascular disease. While we did not find specific research documentation in this area, we are confident that future research will confirm key health benefits from green peas in relationship to cardiovascular protection. Our reasoning here is simple. First, we know that strong antioxidant and anti-inflammatory protection is needed for healthy functioning of our blood vessels. The formation of plaque along our blood vessel walls starts with chronic, excessive oxidative stress and inflammation. Few foods are better equipped to provide us with antioxidant and anti-inflammatory nutrients than green peas. Second, we know that intake of omega-3 fat lowers our risk of cardiovascular problems. Green peas are a reliable source of omega-3 fat in the form of alpha-linolenic acid, or ALA. One cup of green peas provides us with ALA in an amount of approximately 30 milligrams. Third, we know that high levels of homocysteine raise our risk of cardiovascular disease, and that ample amounts of B vitamins are required to help keep our homocysteine levels in check. Green peas provide us with very good amounts of vitamin B1 and folate, and good amounts of vitamins B2, B3, and B6. The critical cardioprotective B vitamin, choline, is also provided by green peas in amounts of approximately 40 per cup. In combination, these nutrient features of green peas point to a likely standout role for this food in protection of our cardiovascular health.

Protection Against Stomach Cancer

Excessive inflammation and oxidative stress are risk factors not only for the development of chronic diseases like type 2 diabetes, but also for the development of cancers. A recent research study has begun to examine the benefits of green peas with respect to one particular type of cancer—stomach cancer. Stomach cancer (also called gastric cancer) is a disease that occurs more commonly in persons who have very low intake of antioxidant and anti-inflammatory nutrients, including key nutrients called polyphenols. A recent study based in Mexico City has shown that daily consumption of green peas along with other legumes is associated with decreased risk of stomach cancer. In particular, decreased risk of stomach cancer in this study was associated with average daily intake of a polyphenol called coumestrol at a level of 2 milligrams or higher. Pulses (including green peas) were determined to be a key food contributor to coumestrol in this Mexico-based study. Since one cup of green peas contains at least 10 milligrams of coumestrol, green peas are very likely to provide some unique health benefits in this cancer-prevention area. Of course, coumestrol is not the only cancer-protective nutrient present in green peas! The wide variety of antioxidants and anti-inflammatory phytonutrients in green peas is very likely to play a primary role in the cancer-preventive benefits of this food.

Description

Legumes are plants that bear fruit in the form of pods enclosing the fleshy seeds we know as beans. Peas are one of the few members of the legume family that are commonly sold and cooked as fresh vegetables. Other members of the legume family, including lentils, chickpeas, and beans of all colors are most often sold in dried form. There are generally three types of peas that are commonly eaten: garden or green peas (*Pisum sativum*), snow peas (*Pisum sativum var. macrocarpon*) and snap peas (*Pisum sativum var. macrocarpon ser. cv.*). Garden peas have rounded pods that are usually slightly curved in shape with a smooth texture and vibrant green color. Inside of them are green rounded pea seeds that are sweet and starchy in taste. Snow peas are flatter than garden peas, and since they are not fully opaque, you can usually see the shadows of the flat peas seeds within. Snap peas, a cross between the garden and snow pea, have plump pods with a crisp, snappy texture. The pods of both snow peas and snap peas are edible, and both feature a slightly sweeter and cooler taste than the garden pea. Peas and other legumes belong to the plant family known as the *Fabaceae*, which is also commonly called the bean family or the pulse family. In fact, commercial production of peas is commonly placed within the category of pulse production, and like its fellow legumes, peas are often referred to as "pulses."

History

The modern-day garden pea is thought to have originated from the field pea that was native to central Asia and the Middle East. Because its cultivation dates back thousands and thousands of years, the green pea is widely recognized as one of the first food crops to be cultivated by humans. Peas were apparently consumed in dry form throughout much of their early history, and did not become widely popular as a fresh food until changes in cultivation techniques that took place in Europe in the 16th century. Peas are now grown throughout the world in nearly every climatic zone, and are widely consumed in both fresh and dried form.

While growing approximately 3 million tons of peas per year, Canada is currently the largest world producer and exporter of peas. France, China, Russia, and India are also large-scale producers of this legume. Despite being a large-scale producer of peas, India is also the world's largest importer of this food due to its great popularity in that country.

How to Select and Store

Only about 5% of the peas grown are sold fresh; the rest are either frozen or canned. When trying to decide between frozen and canned green peas, the following information may be helpful:

- Frozen peas are better able to retain their color, texture, and flavor than canned peas. Recent research has confirmed that these "important sensory characteristics" of green peas are not affected by freezing over periods of 1-3 months.
- Both canned and frozen peas may contain relatively high levels of sodium. Unless labeled as "low sodium" or "reduced sodium" or containing "50% less sodium" or something similar, you can expect to find 650-800 milligrams of sodium in one cup of canned green peas. Some of this sodium can be removed by thorough rinsing, and we definitely encourage you to do so. Reduced sodium canned peas will often bring the sodium content down to 250-300 milligrams of sodium. Even in this case, you can lower the sodium even further by thoroughly rinsing the peas. In the case of frozen green peas, it's not uncommon to find 300 milligrams of sodium in one cup of frozen green peas—approximately the same amount as found in reduced sodium canned peas. This relatively high sodium level in frozen peas results from green pea processing methods, not from the natural sodium content of the peas. When large batches of peas are prepared for freezing, producers separate out the older and starchier peas prior to freezing. A common method used to separate out the starchier peas is to immerse them in salty water. This process, called the salt brine process, allows the younger, more tender, and less starchy peas to float on top of the salt water, while letting the older, less tender, and starchier peas to sink to the bottom. Even though the younger and less starchy peas are rinsed with water after being separated out, they can still contain relatively high levels of sodium.
- Neither frozen peas nor canned peas have an unlimited shelf life. In the case of frozen peas, it's not uncommon to see "use by" dates that indicate a 24-30 month shelf life. However, based on the overall research findings on nutrient content of frozen peas during storage, we recommend that you consume your frozen peas within 6-12 months of the packing date. (If no packing date is available, just make the "use by" date 50% sooner.)

Overall, we recommend the selection of frozen peas over canned peas and recognize the convenience of frozen over fresh. However, we also encourage you to consider fresh peas whenever possible, and to choose them according to the following guidelines.

When purchasing fresh garden peas, look for ones whose pods are firm, velvety and smooth. Their color should be a lively medium green. Those whose green color is especially light or dark, or those that are yellow, whitish or are speckled with gray, should be avoided. Additionally, do not choose pods that are puffy, water soaked or have mildew residue. The pods should contain peas of sufficient number and size that there is not much empty room in the pod. You can tell this by gently shaking the pod and noticing whether there is a slight rattling sound. All varieties of fresh peas should be displayed in a refrigerated case since heat will hasten the conversion of their sugar content into starch.

Unlike the rounded pods of garden peas, the pods of snow peas are flat. You should be able to see the shape of the peas through the non-opaque shiny pod. Choose smaller ones as they tend to be sweeter.

To test the quality of snap peas, snap one open and see whether it is crisp. They should be bright green in color, firm and plump.

Garden peas are generally available from spring through the beginning of winter. Snow peas can usually be found throughout the year in Asian markets and from spring through the beginning of winter in supermarkets. Snap peas are more limited in their availability. They are generally available from late spring through early summer.

If you will not be using fresh peas on the day of purchase, which is the best way to enjoy them, you should refrigerate them as quickly as possible in order to preserve their sugar content, preventing it from turning into starch. Unwashed, unshelled peas stored in the refrigerator in a bag or unsealed container will keep for several days. Loss of some nutrients in green peas—for example, its vitamin C content—is likely to be slowed down through refrigeration.

Fresh peas can also be blanched for one or two minutes and then frozen. If you decide to blanch and freeze your green peas, we recommend a maximum storage period of 6-12 months.

How to Enjoy

A Few Quick Serving Ideas

- Add fresh peas to green salads.
- Healthy Sauté snap peas with shiitake mushrooms.
- Mix green peas with chicken, diced onions and almonds to make a delicious and colorful chicken salad.
- Fresh pea pods are a great food to pack in a lunch box.

WHFoods Recipes That Feature Green Peas

- Mediterranean-Style Salad
- Seared Tuna Salad
- 15-Minute Maui-Style Cod >li>Lemon Fish with Puree of Sweet Peas
- Minted Green Peas & Carrots
- Pureed Sweet Peas
- Sautéed Mushrooms with Green Peas
- Sautéed Vegetables with Cashews

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

<table>
<tr><td colspan="3">Green Peas, cooked
1.00 cup
137.75 grams</td><td colspan="2">Calories: 116
GI: low</td></tr>
<tr><th>Nutrient</th><th>Amount</th><th>DRI/DV (%)</th><th>Nutrient Density</th><th>World's Healthiest Foods Rating</th></tr>
</table>

vitamin K	35.68 mcg	40	6.2	very good
manganese	0.72 mg	36	5.6	very good
fiber	7.58 g	30	4.7	very good
vitamin B1	0.36 mg	30	4.7	very good
copper	0.24 mg	27	4.1	very good
vitamin C	19.56 mg	26	4.1	very good
phosphorus	161.17 mg	23	3.6	very good
folate	86.78 mcg	22	3.4	very good
vitamin B6	0.30 mg	18	2.7	good
vitamin B3	2.78 mg	17	2.7	good
vitamin B2	0.21 mg	16	2.5	good
molybdenum	6.89 mcg	15	2.4	good
zinc	1.64 mg	15	2.3	good
protein	7.38 g	15	2.3	good
magnesium	53.72 mg	13	2.1	good
iron	2.12 mg	12	1.8	good
potassium	373.30 mg	11	1.7	good
choline	40.91 mg	10	1.5	good

World's Healthiest Foods Rating	**Rule**
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Kale

What's New and Beneficial About Kale

- Kale can provide you with some special cholesterol-lowering benefits if you will cook it by steaming. The fiber-related components in kale do a better job of binding together with bile acids in your digestive tract when they've been steamed. When this binding process takes place, it's easier for bile acids to be excreted, and the result is a lowering of your cholesterol levels. Raw kale still has cholesterol-lowering ability—just not as much.
- Kale's risk-lowering benefits for cancer have recently been extended to at least five different types of cancer. These types include cancer of the bladder, breast, colon, ovary, and prostate. Isothiocyanates (ITCs) made from glucosinolates in kale play a primary role in achieving these risk-lowering benefits.
- Kale is now recognized as providing comprehensive support for the body's detoxification system. New research has shown that the ITCs made from kale's glucosinolates can help regulate detox at a genetic level.
- Researchers can now identify over 45 different flavonoids in kale. With kaempferol and quercetin heading the list, kale's flavonoids combine both antioxidant and anti-inflammatory benefits in way that gives kale a leading dietary role with respect to avoidance of chronic inflammation and oxidative stress.

WHFoods Recommendations

You'll want to include kale as one of the cruciferous vegetables you eat on a regular basis if you want to receive the fantastic health benefits provided by the cruciferous vegetable family. At a minimum, we recommend 3/4 cup of cruciferous vegetables on a daily basis. This amount is equivalent to approximately 5 cups per week. A more optimal intake amount would be 1-1/2 cups per day, or about 10 cups per week. You can use our Veggie Advisor for help in figuring out your best cruciferous vegetable options.

Kale is one of the healthiest vegetables around and one way to be sure to enjoy the maximum nutrition and flavor from kale is to cook it properly. We recommend Healthy Steaming kale for 5 minutes. To ensure quick and even cooking cut the leaves into 1/2" slices and the stems into 1/4" lengths. Let them sit for at least 5 minutes to enhance their health-promoting qualities before steaming. See our Healthiest Way of Cooking Kale in the How to Enjoy section below.

Kale, cooked
1.00 cup
(130.00 grams)

Calories: 36
GI: very low

Nutrient	DRI/DV
vitamin K	1180%
vitamin A	98%
vitamin C	71%
manganese	27%
copper	22%
vitamin B6	11%
fiber	10%
calcium	9%
potassium	8%
iron	7%
vitamin E	7%
vitamin B2	7%
magnesium	6%
vitamin B1	6%
protein	5%
phosphorus	5%
omega-3 fats	5%
vitamin B3	4%
folate	4%

Health Benefits

While not as well researched as some of its fellow cruciferous vegetables like broccoli or cabbage, kale is a food that you can count on for some unsurpassed health benefits, if for no other reason than its exceptional nutrient richness. In our own website food rating system, kale scored 4 "excellents," 6 "very goods," and 10 "goods"—for a total of 20 standout categories of nutrient richness! That achievement is difficult for most foods to match.

Antioxidant-Related Health Benefits

Like most of its fellow cruciferous vegetables, kale has been studied more extensively in relationship to cancer than any other health condition. This research focus makes perfect sense. Kale's nutrient richness stands out in three particular areas: (1) antioxidant nutrients, (2) anti-inflammatory nutrients, and (3) anti-cancer nutrients in the form of glucosinolates. Without sufficient intake of antioxidants, our oxygen metabolism can become compromised, and we can experience a metabolic problem called "oxidative stress." Without sufficient intake of anti-inflammatory nutrients, regulation of our inflammatory system can become compromised, and we can experience the problem of chronic inflammation. Oxidative stress and chronic inflammation—and the combination of these metabolic problems—are risk factors for development of cancer. We've seen research studies on 5 specific types of cancer—including bladder cancer, breast cancer, colon cancer, ovarian cancer, and prostate cancer—and intake of cruciferous vegetables (specifically including kale). As a group, these studies definitely show cancer preventive benefits from kale intake, and in some cases, treatment benefits as well.

Kale's cancer preventive benefits have been clearly linked to its unusual concentration of two types of antioxidants, namely, carotenoids and flavonoids. Within the carotenoids, lutein and beta-carotene are standout antioxidants in kale. Researchers have actually followed the passage of these two carotenoids in kale from the human digestive tract up into the blood stream, and they have demonstrated the ability of kale to raise blood levels of these carotenoid nutrients. That finding is important because lutein and beta-carotene are key nutrients in the protection of our body from oxidative stress and health problems related to oxidative stress. Increased risk of cataracts, atherosclerosis, and chronic obstructive pulmonary disease (COPD) are three such problems. Also among these chronic health problems is cancer since our overall risk of cells becoming cancerous is partly related to oxidative stress.

Within the flavonoids, kaempferol is a spotlight antioxidant in kale, followed by a flavonoid called quercitin. But recent research has also made it clear that at least 45 different antioxidant flavonoids are provided in measurable amounts by kale. This broad spectrum of flavonoid antioxidants is likely to be a key to kale's cancer-preventive benefits and benefits that we expect to be documented for other health problems stemming from oxidative stress.

Anti-Inflammatory Health Benefits

We have yet to see research on kale's omega-3 content and inflammation, but we would expect this kind of research to show the omega-3s in kale to be an important part of kale's anti-inflammatory benefits. It only takes 100 calories of kale to provide over 350 milligrams for the most basic omega-3 fatty acid (alpha-linolenic acid, or ALA). We suspect that this amount will be plenty to show direct anti-inflammatory benefits from routine kale intake.

We also have yet to see specific research on inflammation and kale's vitamin K content. But we know that kale is a spectacular source of vitamin K (one cup of kale provides far more micrograms of vitamin K than any of our World's Healthiest foods) and we also know that vitamin K is a key nutrient for helping regulate our body's inflammatory process. Taken in combination, we expect these two facts about vitamin K to eventually get tied together in health research that shows kale to be an exceptional food for lowering our risk of chronic inflammation and associated health problems.

Glucosinolates and Cancer-Preventive Benefits

What we have already seen in the health research on kale is ample evidence that its glucosinolates provide cancer-preventive benefits. Kale is a top food source for at least four glucosinolates, and once kale is eaten and digested, these glucosinolates can be converted by the body into cancer preventive compounds. Kale's glucosinolates and the ITCs made from them have well-documented cancer preventive properties, and in some cases, cancer treatment properties as well. At the top of the cancer-related research for kale are colon cancer and breast cancer, but risk of bladder cancer, prostate cancer, and ovarian cancer have all been found to decrease in relationship to routine intake of kale. The chart below presents a summary of the unusual glucosinlate phytonutrients found in kale, and the anti-cancer ITCs made from them inside the body

Glucosinolates in kale and their detox-activating isothiocyanates

Glucosinolate	Derived Isothiocyanate	Isothiocyanate Abbreviation
glucobrassicin	indole-3-carbinol*	I3C

glucoraphanin	sulforaphane	SFN
gluconasturtiian	phenethyl-isothiocyanate	PEITC
glucopaeolin	benzyl-isothiocyanate	BITC
sinigrin	allyl-isothiocyanate	AITC

* Indole-3-carbinol (I3C) is not an isothiocyanate. It's a benzopyrrole, and it is only formed when isothiocyanates made from glucobrassicin are further broken down into non-sulfur containing compounds.

Cardiovascular Support

You can count on kale to provide valuable cardiovascular support in terms of its cholesterol-lowering ability. Researchers now understand exactly how this support process works. Our liver uses cholesterol as a basic building block to product bile acids. Bile acids are specialized molecules that aid in the digestion and absorption of fat through a process called emulsification. These molecules are typically stored in fluid form in our gall bladder, and when we eat a fat-containing meal, they get released into the intestine where they help ready the fat for interaction with enzymes and eventual absorption up into the body. When we eat kale, fiber-related nutrients in this cruciferous vegetable bind together with some of the bile acids in the intestine in such a way that they simply stay inside the intestine and pass out of our body in a bowel movement, rather than getting absorbed along with the fat they have emulsified. When this happens, our liver needs to replace the lost bile acids by drawing upon our existing supply of cholesterol, and, as a result, our cholesterol level drops down. Kale provides us with this cholesterol-lowering benefit whether it is raw or cooked. However, a recent study has shown that the cholesterol-lowering ability of raw kale improves significantly when it is steamed. In fact, when the cholesterol-lowering ability of steamed kale was compared with the cholesterol-lowering ability of the prescription drug cholestyramine (a medication that is taken for the purpose of lowering cholesterol), kale bound 42% as many bile acids (based on a standard of comparison involving total dietary fiber). Amongst all of the cruciferous vegetables, only collard greens scored higher at 46%.

Other Health-Related Benefits

Kale has a definite role to play in support of the body's detoxification processes. The isothiocyanates (ITCs) made from kale's glucosinolates have been shown to help regulate detox activities in our cells. Most toxins that pose a risk to our body must be detoxified by our cells using a two-step process. The two steps in the process are called Phase I detoxification and Phase II detoxification. The ITCs made from kale's glucosinolates have been shown to favorably modify both detox steps (Phase I and Phase II). In addition, the unusually large numbers of sulfur compounds in kale have been shown to help support aspects of Phase II detoxification that require the presence of sulfur. By supporting both aspects of our cellular detox process (Phase I and Phase II), nutrients in kale can give our body an "edge up" in dealing with toxic exposure, whether from our environment or from our food.

We have yet to see studies that look directly at kale and its support for our digestive system. However, we have seen studies for kale's fellow cruciferous vegetable—broccoli—in this regard, and we definitely expect to see future research that looks directly at kale and our digestive function. We predict that one area of digestive support provided by kale will turn out to involve fiber. We feel that 7 grams of fiber per 100 calories of kale is just too much fiber to fail in the digestive benefits category. We predict that a second area of digestive benefits will involve kale's glucosinolates. The ITCs make from kale's glucosinolates should help protect our stomach lining from bacterial overgrowth of *Helicobacter pylori* and should help avoid too much clinging by this bacterium to our stomach wall.

Description

The beautiful leaves of the kale plant provide an earthy flavor and more nutritional value for fewer calories than almost any other food around. Although it can be found in markets throughout the year, it is in season from the middle of winter through the beginning of spring when it has a sweeter taste and is more widely available.

Kale is a leafy green vegetable that belongs to the Brassica family, a group of vegetables including cabbage, collards, and Brussels sprouts that have gained recent widespread attention due to their health-promoting, sulfur-containing phytonutrients. It is easy to grow and can grow in colder temperatures where a light frost will produce especially sweet kale leaves. There are several varieties of kale; these include curly kale, ornamental kale, and dinosaur (or Lacinato or Tuscan) kale, all of which differ in taste, texture, and appearance. The scientific name for kale is *Brassica oleracea*.

Curly kale has ruffled leaves and a fibrous stalk and is usually deep green in color. It has a lively pungent flavor with delicious bitter peppery qualities.

Ornamental kale is a more recently cultivated species that is oftentimes referred to as salad savoy. Its leaves may either be green, white, or purple and its stalks coalesce to form a loosely knit head. Ornamental kale has a more mellow flavor and tender texture.

Dinosaur kale is the common name for the kale variety known as Lacinato or Tuscan kale. It features dark blue-green leaves that have an embossed texture. It has a slightly sweeter and more delicate taste than curly kale.

History

Like broccoli, cauliflower, and collards, kale is a descendent of the wild cabbage, a plant thought to have originated in Asia Minor and to have been brought to Europe around 600 B.C. by groups of Celtic wanderers. Curly kale played an important role in early European foodways, having been a significant crop during ancient Roman times and a popular vegetable eaten by peasants in the Middle Ages. English settlers brought kale to the United States in the 17th century.

Both ornamental and dinosaur kale are much more recent varieties. Dinosaur kale was discovered in Italy in the late 19th century. Ornamental kale, originally a decorative garden plant, was first cultivated commercially as in the 1980s in California. Ornamental kale is now better known by the name salad savoy.

How to Select and Store

Look for kale with firm, deeply colored leaves and moist hardy stems. Kale should be displayed in a cool environment since warm temperatures will cause it to wilt and will negatively affect its flavor. The leaves should look fresh, be unwilted, and be free from signs of browning, yellowing, and small holes. Choose kale with smaller-sized leaves since these will be more tender and have a more mild flavor than those with larger leaves. Kale is available throughout the year, although it is more widely available, and at its peak, from the middle of winter through the beginning of spring.

To store, place kale in a plastic storage bag removing as much of the air from the bag as possible. Store in the refrigerator where it will keep for 5 days. The longer it is stored, the more bitter its flavor becomes. Do not wash kale before storing because exposure to water encourages spoilage. Loss of some nutrients in kale—for example, its vitamin C content—is likely to be slowed down through refrigeration.

How to Enjoy

A Few Quick Serving Ideas

- Braise chopped kale and apples. Before serving, sprinkle with balsamic vinegar and chopped walnuts.
- Combine chopped kale, pine nuts, and feta cheese with whole grain pasta drizzled with olive oil.

WHFoods Recipes That Feature Kale

- Healthy Breakfast Frittata
- Italian Tofu Frittata
- Poached Eggs Over Sauteed Greens
- Minestrone Surprise
- Spicy Posole Soup
- Super Energy Kale Soup
- Turkey and Vegetable Chili Verde
- Sesame Braised Chicken & Cabbage
- Indian Style Lamb with Sweet Potatoes
- 5-Minute Kale
- 5-Minute Kale with Sea Vegetables

Safety

Kale and Goitrogens

You may sometimes hear kale being described as a food that contains "goitrogens," or as a food that is "goitrogenic." For helpful information in this area—including our WHFoods Recommendations—please see our article What is meant by the term "goitrogen" and what is the connection between goitrogens, food, and health?.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Kale, cooked **1.00 cup** **130.00 grams**				**Calories: 36** **GI: very low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin K	1062.10 mcg	1180	583.6	excellent
vitamin A	885.36 mcg RAE	98	48.6	excellent
vitamin C	53.30 mg	71	35.1	excellent
manganese	0.54 mg	27	13.4	excellent
copper	0.20 mg	22	11.0	excellent
vitamin B6	0.18 mg	11	5.2	very good
fiber	2.60 g	10	5.1	very good
calcium	93.60 mg	9	4.6	very good
potassium	296.40 mg	8	4.2	very good
vitamin E	1.11 mg (ATE)	7	3.7	very good
vitamin B2	0.09 mg	7	3.4	very good
iron	1.17 mg	7	3.2	good
magnesium	23.40 mg	6	2.9	good
vitamin B1	0.07 mg	6	2.9	good
omega-3 fats	0.13 g	5	2.7	good
phosphorus	36.40 mg	5	2.6	good
protein	2.47 g	5	2.4	good
folate	16.90 mcg	4	2.1	good
vitamin B3	0.65 mg	4	2.0	good

World's Healthiest Foods Rating	**Rule**
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Leeks

WHFoods Recommendations

With their unique combination of flavonoids and sulfur-containing nutrients, the allium vegetables belong in your diet on a regular basis. There's research evidence for including at least one serving of an allium vegetable in your meal plan every day. If you're choosing leeks, make your individual portion 1/2 cup or greater, and try to include at least one cup of chopped leeks in your recipes.

Many people are unfamiliar with how to cook leeks or how to include them in a Healthiest Way of Eating. We recommend cutting them very thinly and preparing them by using our Healthy Sauté method of cooking. Like their allium cousins, onions and garlic, let leeks sit for at least 5 minutes after cutting and before cooking. Our Tips for Preparing and Cooking and How to Enjoy sections below will give you more details on the best ways to bring leeks into your meal plan.

Leeks, cooked
1.00 cup
(104.00 grams)

Calories: 32
GI: medium

Nutrient	DRI/DV
vitamin K	29%
manganese	13%
copper	7%
vitamin B6	7%
folate	6%
vitamin C	6%
iron	6%
vitamin A	5%
fiber	4%
magnesium	4%
calcium	3%
vitamin E	3%
omega-3 fats	3%

Health Benefits

Leeks, like garlic and onions, belong to a vegetable family called the Allium vegetables. Since leeks are related to garlic and onions, they contain many of the same beneficial compounds found in these well-researched, health-promoting vegetables.

Cardiovascular Support

Leeks contain important amounts of the flavonoid kaempferol, which has repeatedly been shown to help protect our blood vessel linings from damage, including damage by overly reactive oxygen molecules. Interestingly, one of the mechanisms involved in this blood vessel protection may involve increased production of nitric oxide (NO), a naturally occurring gas that helps to dilate and relax the blood vessels, as well as decreased production of that asymmetric dimethylarginine (ADMA), a substance that blocks production of NO.

Often overlooked in leeks is their important concentration of the B vitamin folate. Folate is present in leeks in one of its bioactive forms (5-methyltetrahydrofolate, or 5MTHF) and it is present throughout the plant (including the full leaf portion, not only the lower leaf and bulb). While it's true that we still get about 50% more 5MTHF from the bulb than the leaves, this distribution of folate throughout the plant makes leeks a cardioprotective food from top to bottom. (Folate is a key B complex vitamin for supporting our cardiovascular system, because it helps keep our levels of homocysteine in proper balance. Excessively high levels of homocysteine are a risk factor for many cardiovascular diseases.)

Also present in leeks are impressive concentrations of antioxidant polyphenols. These polyphenols play a direct role in protecting our blood vessels and blood cells from oxidative damage. The total polyphenol content (TPC) of leeks averages about 33 milligrams of gallic acid equivalents (GAE) per 100 grams of fresh edible portion (FEP). By contrast, the TPC of red bell peppers averages 27 milligrams; cherry tomatoes, 24 milligrams; and carrots, 10 milligrams. So even though leeks are less concentrated than some of their fellow allium vegetables in terms of total polyphenols (garlic provides about 59 milligrams GAE/100g FEP, and onions provide about 76 milligrams), they are still a highly valuable food in terms of these phytonutrient antioxidants and provide us with important cardiovascular benefits for this reason.

Other Health Benefits

Unfortunately, leeks have received less research attention than their fellow allium vegetables (especially garlic and onions), and for this reason, there is less documentation of their likely health benefits. Given their substantial polyphenol content, including their notable amounts of kaempferol, we would expect to see overlap with garlic and onions in terms of support for many health problems related to oxidative stress and chronic low-level inflammation. These health problems would include atherosclerosis, type 2 diabetes, obesity, rheumatoid arthritis, and allergic airway inflammation. We would also expect to see leeks providing measurable amounts of protection against several different types of cancer, mostly likely including colorectal cancer. It's important to remember that even in the absence of research studies to confirm health benefits, leeks still belong to the same allium vegetable family as onions and garlic and contain many health-supportive substances that are similar to (or identical with) the substances in their fellow allium vegetables.

Description

Leeks, known scientifically as *Allium porrum*, are related to garlic, onions, shallots, and scallions. Leeks look like large scallions, having a very small bulb and a long white cylindrical stalk of superimposed layers that flows into green, tightly wrapped, flat leaves. Cultivated leeks are usually about 12 inches in length and one to two inches in diameter and feature a fragrant flavor that is reminiscent of shallots but sweeter and more subtle. Wild leeks, known as ramps, are much smaller in size, but have a stronger, more intense flavor. They are available for a short period of time each year and are often widely sought out at farmers markets when they are in season.

With a more delicate and sweeter flavor than onions, leeks add a subtle touch to recipes without overpowering the other flavors that are present. Although leeks are available throughout the year they are in season from the fall through the early part of spring when they are at their best.

The flavonoids in leeks are most concentrated in their lower leaf and bulb portion. The flavonol kaempferol is one of leeks' premiere flavonoids, and it's also most concentrated in the lower leaf and bulb. Leeks rank ahead of white onions in terms of their kaempferol content, but they still provide slightly less kaempferol than red onions. For other types of flavonoids, including quercetin, leeks appear to provide lower concentrations than most types of onions.

History

Leeks enjoy a long and rich history, one that can trace its heritage back through antiquity. Thought to be native to Central Asia, they have been cultivated in this region and in Europe for thousands of years.

Leeks were prized by the ancient Greeks and Romans and were especially revered for their beneficial effect upon the throat. The Greek philosopher Aristotle credited the clear voice of the partridge to a diet of leeks, while the Roman emperor Nero supposedly ate leeks everyday to make his voice stronger.

The Romans are thought to have introduced leeks to the United Kingdom, where they were able to flourish because they could withstand cold weather. Leeks have attained an esteemed status in Wales, where they serve as this country's national emblem. The Welsh regard for leeks can be traced back to a battle that they successfully won against that Saxons in 1620, during which the Welsh soldiers placed leeks in their caps to differentiate themselves from their opponents. Today, leeks are an important vegetable in many northern European cuisines and are grown in many European countries.

How to Select and Store

Leeks should be firm and straight with dark green leaves and white necks. Good quality leeks will not be yellowed or wilted, nor have bulbs that have cracks or bruises. Since overly large leeks are generally more fibrous in texture, only purchase those that have a diameter of one and one-half inches or less. Try to purchase leeks that are of similar size so as to ensure more consistent cooking if you are planning on cooking the leeks whole. Leeks are available throughout the year, although they are in greater supply from the fall through the early part of spring.

Fresh leeks should be stored unwashed and untrimmed in the refrigerator, where they will keep fresh for between one and two weeks. Wrapping them loosely in a plastic bag will help them to retain moisture. Loss of some nutrients in leeks—for example, its vitamin C content—is likely to be slowed down through refrigeration.

Cooked leeks are highly perishable, and even when kept in the refrigerator, will only stay fresh for about two days. Leeks may be frozen after being blanched for two to three minutes, although they will lose some of their desirable taste and texture qualities. Leeks will keep in the freezer for about three months.

How to Enjoy

A Few Quick Serving Ideas

- Healthy sauté leeks and fennel. Garnish with fresh lemon juice and thyme.
- Add finely chopped leeks to salads.
- Make vichyssoise, a cold soup made from puréed cooked leeks and potatoes.
- Add leeks to broth and stews for extra flavoring.
- Braised leeks sprinkled with fennel or mustard seeds make a wonderful side dish for fish, poultry or steak.
- Add sliced leeks to your favorite omelet or frittata recipe.

WHFoods Recipes That Feature Leeks

- Poached Eggs Over Sauteed Greens
- Braised Salmon with Leeks
- Sautéed Greens

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Leeks, cooked **1.00 cup** **104.00 grams**				**Calories: 32** **GI: medium**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin K	26.42 mcg	29	16.4	excellent
manganese	0.26 mg	13	7.3	very good
vitamin B6	0.12 mg	7	3.9	very good
copper	0.06 mg	7	3.7	very good
iron	1.14 mg	6	3.5	very good
folate	24.96 mcg	6	3.5	very good
vitamin C	4.37 mg	6	3.3	good
vitamin A	42.22 mcg RAE	5	2.6	good
fiber	1.04 g	4	2.3	good
magnesium	14.56 mg	4	2.0	good
vitamin E	0.52 mg (ATE)	3	1.9	good
calcium	31.20 mg	3	1.7	good
omega-3 fats	0.07 g	3	1.6	good

World's Healthiest	

Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Mushrooms, crimini

What's New and Beneficial About Crimini Mushrooms

- You can definitely make a difference in the health benefits you get from mushrooms by being extra careful with the temperature at which you store them. A recent study looked at color and texture changes in mushrooms over a 6-8 day period, including color changes that were associated with the mushrooms' phytonutrient content (discoloration was related to a reduction in these important nutrients). As temperatures moved closer and closer to room temperature (the researchers stopped at 59°F/15°C in their study), discoloration and hardening became more and more problematic. Prevention of discoloration and hardening required the researchers to take the temperature down all the way to 38°F/3°C over this 6-8 day period. Since 38°F/3°C is great temperature setting for your home refrigerator, what we're talking about here is careful refrigeration of mushrooms as soon as you've arrived back home from the grocery store. Leaving mushrooms out on the countertop is worth avoiding, and you never want to store them even temporarily in a cabinet.
- Like most mushrooms, crimini mushrooms can provide us with unique immune system support. But contrary to public belief, these common button-type mushrooms have recently been shown to surpass some of their more exotic mushroom counterparts (like shiitake or maitake mushrooms) in terms of immune system benefits. We've seen several recent studies that placed button mushrooms at the top of the mushroom list with respect to regulation of unwanted inflammation. Included here were studies on laboratory animals involving the development of arthritis--an area where we expect to see more news about the health benefits of mushrooms.
- Protection against cardiovascular disease has become an area of special research interest in crimini mushrooms. Along with extracts from oyster, shiikate, maitake, and white button mushrooms, extracts from crimini mushrooms have been found to reduce the binding of certain immune cells onto the lining of the aorta. When mushrooms reduce this binding, they also lower risk of damage to the aorta and risk of blood flow problems.
- For women who are at risk of hormone-dependent breast cancer, crimini mushrooms may be an important diet addition. These mushrooms have recently been shown to be a significant source of conjugated linolenic acid (CLA)—a unique type of fatty acid that can bind onto aromatase enzymes and lessen the production of estrogen. Since some breast cancer tumors are dependent upon estrogen for their growth, this blocking of the aromatase enzyme by the mushrooms' CLA may lower risk of this breast cancer type. The presence of CLA in mushrooms is fascinating, because we typically expect to find this type of fatty acid exclusively in animal foods like milk, cheese, and meats.
- Crimini mushrooms may sometimes be a valuable source of vitamin B12. Even though this B12 issue can be a little confusing, we believe it's important for you to know that recent studies have found significant amounts of vitamin B12 in some samples of fresh crimini mushrooms. The B12 in these mushrooms was apparently produced by healthy bacteria growing on the surface of the fresh mushrooms. Mushroom content of B12 varied significantly, and sometimes it varied from farm to farm. That kind of diversity makes sense to us because growing conditions for mushrooms can vary dramatically. Traditionally, we've thought about animal foods as being our only reliable source of vitamin B12. Animals tend to store up small amounts of this vitamin after it has been produced via being consumed in a food or produced by bacteria in their digestive tract. This way of thinking about vitamin B12 still holds true. However, it might also be smart for us to start thinking about fresh mushrooms (including fresh crimini mushrooms) as a potentially valuable source of vitamin B12. While we cannot ask fresh mushrooms for a vitamin B12 guarantee, we can count on them for a variety of other important health benefits, and along with these benefits, we may also be getting a boost in our B12 intake.

WHFoods Recommendations

People do not usually consider mushrooms, including crimini mushrooms, as a part of their meals that can offer great nutritional value. However, the nutritional value of crimini mushrooms may surprise you. One cup of crimini mushrooms provides a good, very good, or excellent source of 15 different vitamins, minerals, and antioxidant phytonutrients. To maximize their flavor and the retention of their nutrients it is important to not to overcook them. That's why we recommend healthy sautéeing crimini mushrooms for just 7 minutes to bring out their best flavor while maximizing their nutrient retention. For more on our Healthiest Way of Cooking crimini mushrooms see the How to Enjoy section.

Mushrooms, Crimini, raw
1.00 cup
(72.00 grams)

Calories: 16
GI: very low

Nutrient	DRI/DV
copper	40%
selenium	34%
vitamin B2	27%

pantothenic acid	22%
vitamin B3	17%
phosphorus	12%
potassium	9%
zinc	7%
vitamin B1	6%
folate	5%
vitamin B6	5%
manganese	5%
protein	4%
choline	4%
vitamin B12	3%

Health Benefits

Immune System Support

White blood cells play a key role in the health of our immune system, and without healthy and balanced activity on the part of our white blood cells, we cannot protect ourselves from diseases caused by microorganisms or from allergy-related problems. There are many important types of white blood cells, and these include monocytes, macrophages, and dendritic cells. All three types of immune cells have their activity levels shifted by substances found in crimini mushrooms! In a remarkable way, unique phytonutrients found in crimini mushrooms change the way these white blood cells go about their business. In some cases, they prevent white blood cells from becoming active when they would be better off remaining inactive. In other cases, they trigger white blood cell activity when more activity is needed. The list of immune-impacting phytonutrients in crimini mushroom is both unusual and lengthy. It includes beta-D-glucans, fucogalactans, APO (2-amino-3H-phenoxazin-3-one), p-tolyl-hydrazine, and a wide range of substances involving unique combinations of protein-plus-carbohydrate components. The role of a healthy immune system in helping protect us against arthritis, development of cancer, and development of cardiovascular disease has been examined with a focus on dietary mushroom intake, and evidence suggests that crimini mushrooms can help lower our risk of these health problems by supporting balanced activities among the white blood cells of our immune system.

One final note may be in order when thinking about crimini mushrooms and our immune system. One key nutrient for healthy immune system function is vitamin D, and crimini mushrooms do provide measurable amounts of this vitamin. However, the relationship of vitamin D to mushrooms can be complicated. The form of vitamin D most commonly found in mushrooms is ergosterol (sometimes called vitamin D1). This form of the vitamin is not active in humans as a hormone. With the help of sunlight, some of the ergosterol in mushrooms can be converted into ergocalciferol (sometimes called vitamin D2). However, since mushrooms do not require sunlight for growth, they are sometimes produced without exposure to light and, in this case, would not provide D2. (Some mushroom growers deliberately expose mushrooms that are being grown in the dark to a short burst of light that can help some of the D1 in mushrooms get converted into D2.) Even though D2 can be useful to our cells, this D2 form of vitamin D is still not the fully active hormonal form. That fully active form (vitamin D3, cholecalciferol) is not provided by mushrooms whether exposed to light or not. From our perspective, the bottom line for vitamin D and mushrooms is much like the bottom line for vitamin B12 and mushrooms. You cannot count on mushrooms to be helpful with your vitamin D requirements (just like you cannot count on them to be helpful in meeting your vitamin B12 requirements), but you may end up getting some bonus vitamin D (and vitamin B12) benefits from crimini mushrooms, along with their other amazing health-supportive nutrients.

Anti-Inflammatory Benefits

Risk of many common health problems—including type 2 diabetes, cardiovascular disease, and certain types of cancer—is increased by the presence of chronic unwanted inflammation. Many factors can contribute to chronic inflammation, and these factors include overproduction of molecules in our body that tell it to launch an inflammatory response. If production of these molecules—called pro-inflammatory molecules—can be reduced, chronic inflammation can be reduced or sometimes prevented altogether. Intake of whole fresh mushrooms, mushroom extracts, and powdered/dried mushrooms has been shown to accomplish precisely this result—blocked production of pro-inflammatory molecules. In some studies, crimini mushroom appears to be a better blocker of certain pro-inflammatory molecules than its fellow mushrooms like shiitake and maitake. These anti-inflammatory studies have usually been conducted on laboratory animals, and have usually focused on pro-inflammatory molecules like IL-10 (interleukin-10), IL-12 (interleukin-12), and IFN-gamma (interferon-gamma). The results of these studies have been consistent and also clear: to avoid chronic overproduction of pro-inflammatory molecules, it's helpful to include crimini mushrooms in a diet.

Antioxidant Benefits

There are two outstanding types of antioxidant support provided by crimini mushrooms. The first type involves their nutrient composition, and the second type involves their impact on oxidative metabolism. In terms of nutrients, you don't have to look far to find key players in antioxidant world: crimini mushrooms provide an excellent amount of selenium, and a very good amount of zinc and manganese. All three minerals are critical antioxidant nutrients and are also required for the functioning of antioxidant enzymes. The antioxidant content of crimini mushrooms also includes some unusual antioxidant molecules. The best studied of these molecules is ergothioneine (technically identified as 2-mercaptohistidine trimethylbetaine). Ergothioneine is an amino acid-like molecule that has not only been shown to have antioxidant properties but to also specifically help prevent oxidative damage to DNA (our genetic material) and proteins.

In addition to providing us with these key antioxidant nutrients, mushrooms also impact our oxidative metabolism. Intake of crimini mushrooms and crimini mushrooms extracts has been studied in relationship to the activity of several oxidative enzymes, including SOD (superoxide dismutase), CAT (catalase), and GPO (glutathione peroxidase). Most of these oxidative enzyme studies have been conducted on animals, including mice, rats, and chickens. Addition of mushroom to the animals' diets in relatively small amounts has been shown to increase enzyme activity and in the case of GPO, to increase the cell's supply of glutathione (GSH) itself. In the minds of many researchers, GSH may be a central antioxidant in many cellular activities.

Cardiovascular Benefits

Since the health of our circulatory system depends on great antioxidant protection and effective regulation of inflammation, it is not surprising to see crimini mushrooms providing impressive cardiovascular benefits. This mushroom is simply to rich in antioxidant and anti-inflammatory nutrients to go unheralded in this cardiovascular area. As might be expected, research studies show that crimini mushrooms can help protect us from cardiovascular disease by protecting our blood vessels from oxidative damage as well as chronic inflammation. This protection has been specifically shown with respect to the aorta--our body's largest blood vessel. Cardiovascular protection by crimini mushrooms extends beyond these antioxidant and anti-inflammatory areas, however. Research studies on laboratory animals with high blood levels of total cholesterol, LDL cholesterol, and triglycerides (TGs) have also shown that daily intake of crimini mushrooms over a period of 1-2 months can reduce levels of all three blood fats (total cholesterol, LDL cholesterol, and TGs.

The cardiovascular benefits from crimini mushrooms also involve their B vitamins. In addition to being an excellent source of vitamins B2, B3 (niacin), and B5 (pantothenic acid), crimini mushrooms are a very good source of vitamin B1, and good source of vitamin B6, folate, and choline. As described earlier in this profile, these mushrooms also sometimes provide us with a significant amount of vitamin B12. The B vitamin choline (about 19 milligrams per cup) is also provided by this B vitamin-rich food. One hallmark risk factor for cardiovascular disease (especially atherosclerosis) is an elevated level of homocysteine. This amino acid lies at the intersection of many complicated metabolic pathways important to the healthy function of our cardiovascular system. Deficiencies of vitamins B6 and B12 or folate can increase our risk of elevated homocysteine and, along with it, our risk of cardiovascular disease. By providing us with these critical homocysteine-balancing B vitamins, crimini mushrooms provide us with yet another tool for improving our cardiovascular health.

Anti-Cancer Benefits

A fascinating twist in the story of crimini mushrooms, immune support, and anti-inflammatory benefits involves cancer cells. In some ways, cancer cells can be considered the opposite of healthy cells. With healthy cells, we want to avoid chronic inflammation, and we want our immune system to maintain a sense of respect for the miraculous functioning of each healthy cell. With cancer cells, the situation is somewhat reversed. In the case of cancer cells, we would like our immune system to be unusually active and to send out white blood cells that can dismantle and deactivate cancerous or cancer-like cells.

In some situations, it can also be helpful for inflammatory activity to be increased in cancer cells. Increased activity of pro-inflammatory molecules (for example, prostaglandin E2, also called PGE2) can sometimes cause a cancer cell to shift itself over into a process called apoptosis (programmed cell death). In this case, the cancer cell can be prevented from causing more disruption among healthy cells.

The immune system's ability to actively detect and deactivate cancer cells (or potentially cancerous cells) and the inflammatory system's ability to help trigger apoptosis in cancer cells (or potentially cancerous cells) are abilities that can be enhanced by intake of crimini mushrooms. We've seen recent studies on laboratory animals as well as lab studies on different cancer cell lines that show significant anti-cancer benefits from crimini mushroom extracts and also from dried, powdered crimini mushrooms. (Extracts and dried powder forms are used to enable measured consumption by the laboratory animals.)

Of special interest in this health benefits area have been studies on breast cancer and prostate cancer. In the case of breast cancer—especially hormone-related breast cancer—it may be the presence of a special fatty acid called CLA (conjugated linoleic acid) in mushrooms that is especially important. CLA may be able to bind onto *aromatase* enzymes in the cancer cells and lessen their ability to produce estrogen. Since some breast cancer tumors are dependent upon estrogen for their growth, this blocking of the *aromatase* enzyme by the mushrooms' CLA may help prevent or control this type of tumor. In the case of prostate cancer, blocking of the *aromatase* enzyme by CLA has also been a research focus since prostate cancer cells are known to produce *aromatase* enzymes. Blocking of a second type of enzyme (called *5-alpha reductase*) by mushroom extracts has also been a focus of prostate cancer studies. It's important to remember that most types of cancer begin their development in situations where there has been chronic unwanted inflammation related to lack of anti-inflammatory nutrients and also in situations where there has been chronic unwanted oxidative stress due to lack of antioxidant nutrients. By providing us with their unique mix of anti-inflammatory and antioxidant nutrients, crimini mushrooms may be able to help us decrease our cancer risk not only for breast and prostate cancer, but for other cancer types as well.

Description

Crimini mushrooms are a coffee-colored variety of the world's most commonly eaten mushroom, commonly called the "button" mushroom. The names "white button," "crimini" and "portobello" all refer to this same scientific category of mushroom, *Agaricus bisporus*. Different strains (also called "isolates") of *Agaricus bisporus* are used in commercial mushroom production along with varied growing conditions and varied time periods of cultivation to produce different varieties this of widely loved food. White button varieties are typically obtained from select strains that can be harvested at a relatively immature stage of growth. Strains used to produce crimini mushrooms are typically harvested at an intermediate growth stage. Baby bella mushroom, mini bella mushroom, baby portobello mushroon, and portobellini mushroom are other names for crimini mushrooms. Crimini mushrooms are also sometimes referred to simply as "brown mushrooms." Portobello mushrooms are crimini mushrooms that have been allowed to grow to full maturity.

Mushrooms are as mysteriously unique as they are delicious. While often thought of as a vegetable and prepared like one, mushrooms are actually fungi, a special type of living organism that has no roots, leaves, flowers, or seeds. Technically speaking, mushrooms are not vegetables. In fact, technically speaking, mushrooms are not even plants! Mushrooms do not require either soil or light in order to grow. All that's required is decaying organic matter of some kind, including the kind found in decaying wood, decaying leaves, or manure. While mushrooms can be cultivated, they easily grow wild in many regions of the world due to their unusual and fairly simple growth requirements.

The unique nature of mushrooms as a fungus that grows on decaying matter is one of the reasons that we encourage purchase of certified organic mushrooms. Growth media used in the commercial production of non-organic crimini mushrooms can be inconsistent in terms of quality, and we believe that your risk of contamination with pesticides, heavy metals, and other unwanted substances will often be lowered through the purchase of certified organic mushrooms. (At present, there are no organic certification standards created exclusively for mushroom production. But at the same time, many organic standards created for production of all foods apply to the growing of organic mushrooms as well. For example, regulations for the composting of manure in production of certified organic mushrooms are stricter than the regulations for the composting of manure in production of non-organic mushrooms.)

History

Button mushrooms have grown wild since prehistoric times, having been consumed as food by the early hunter-gatherers. Since ancient times, mushrooms have been thought to have special powers. The Egyptians thought that they granted immortality, and since only the pharaohs were felt to be worthy of this gift, the common people were not even allowed to touch mushrooms, let alone eat them. In ancient Rome, people oftentimes referred to mushrooms as *cibus diorum*—food for the gods. The folklore of many cultures, including Russia, China, and Mexico held that eating mushrooms could give someone superhuman strength.

Historians are not entirely certain about the time period in which humans first began cultivation of mushrooms for food, but this cultivation most likely began in Asia, involving cultivation in China, Japan, and India. The first Western cultivation dates back to the 17th century in Europe. Especially well-known is mushroom cultivation that began in France, specifically in the catacombs (underground caves and tunnels) that lay beneath the city of Paris. The button mushrooms are sometimes referred to as Paris mushrooms ("champignons de Paris") for this reason. Mushrooms are still commercially produced underground in the Tours and Saumur regions of France. China is currently the world's largest commercial producer of mushrooms, following by Europe and then the United States. Within the U.S., about 70% of all mushrooms are grown on the east coast, with the state of Pennsylvania having the highest U.S. yields.

How to Select and Store

Look for crimini mushrooms that are firm, plump, clean and brown in color. Those that are wrinkled or have wet slimy spots should be avoided. If your recipe calls for caps only, choose mushrooms that have short stems to avoid waste. Fresh and dried button mushrooms are available throughout the year.

When selecting mushrooms, we encourage you to choose certified organic versions. Even though we encourage the purchase of organic for all foods, we believe that it's important to understand some of the potential differences between mushrooms that have been produced organically versus non-organically. Unlike wild mushrooms, commercially produced mushrooms are the result of a complicated cultivation process that involves three distinct steps.

The first step involves composting. The goal of this first step is to create an environment (substrate) in which the mushrooms can grow. The preparation of compost often includes the use of animal manure, and we believe that rules for the organic composting of animal manure are both stricter than the rules for non-organic compositing and can result in healthier compost.

The second step involves spawning. Because the spores (reproductive elements) of mushrooms are too small for growers to handle directly, they are germinated to form threadlike substances called mycelia, and then combined with grains to form what is called "spawn." Organic regulations for seed stock and seed preparation apply to preparation of spawn in mushroom production, and, once again, we believe that the stricter organic regulations can result in healthier spawn. Once the spawn have been prepared, they are added to the compost and allowed to develop into mushroom colonies. During this spawn colonization step, the mushrooms remain in their vegetative state of development. They have yet to look anything like the mushrooms we purchase in the grocery store.

A final step in the mushroom production process is to trigger a change in their development from the vegetative phase to the reproductive (fruiting) phase—allowing the mushrooms to transform into their familiar food form. In order to trigger this change, an additional later of material is added to the spawned compost. This layer of material—called the casing—may include field soil, leftover mushroom substrate (called spent mushroom substrate) or other substances including sphagnum peat moss. Once again, we believe that the stricter organic regulations for soil and soil amendments can help to produce a healthier final product. Examples of unwanted contaminants that may be greatly reduced or eliminated by stricter organic standards include synthetic herbicides, insecticides, and heavy metals.

The best way to store loose button mushrooms is to keep them in the refrigerator in a loosely closed paper bag wrapped in a damp cloth or laid out in a glass dish that is covered with a moist cloth. Whether you use a paper bag, a damp cloth, or a glass dish, it's worth avoiding all storage methods that leave the mushrooms stacked in one big clump. The less surface contact they have with one another the fresher they will stay. A great step to avoid clumping is to make a first layer of mushrooms inside your paper bag or on top of your damp cloth or glass dish, and then cover this mushroom layer with a paper towel. A second layer of mushrooms can then be placed on top of the paper towel. These storage methods will help preserve the mushrooms' moisture without causing them to become soggy and keep them fresh for several days. Once mushrooms have developed a slimy layer across their surface, they are not longer fully fresh.

Mushrooms that are purchased prepackaged can usually be stored in the refrigerator for 3-7 days. However, to maximize freshness, we recommend removal from the original container and storage according to one of the methods described above. Recent research has shown refrigerator storage to be especially important for preserving mushroom phytonutrients. In research studies on button mushrooms, loss of phytonutrients related to discoloration and hardening of mushrooms has been shown to occur over a 6-8 day period as storage temperatures get increased from 38F/3C (a common household refrigerator temperature) to 59F/15C (a temperature much closer to room temperature). These study findings are good reasons not to leave mushrooms sitting out on the countertop or even storing them temporarily in a cabinet.

Dried mushrooms should be stored in a tightly sealed container in either the refrigerator or freezer, where they will stay fresh for six months to one year.

How to Enjoy

A Few Quick Serving Ideas

- Healthy sautéed mushrooms and onions make a great side dish
- Add finely chopped mushrooms to a pot of tomato pasta sauce.
- After removing the stems from mushrooms, stuff them with your favorite vegetable medley or soft cheese.
- Make the classic brunch favorite...the mushroom omelet.

WHFoods Recipes That Feature Crimini Mushrooms

- Mushroom, Tomato, Basil Frittata
- Poached Eggs over Spinach & Mushrooms
- Crispy Turkey Salad
- Healthy Chicken Caesar Salad
- Healthy Turkey Salad
- Healthy Veggie Salad
- Mediterranean-Style Salad
- Barley Mushroom Soup
- Minestrone Surprise
- Broiled Rosemary Chicken over Pureed Lentils
- Holiday Turkey with Rice Stuffing & Gravy with Fresh Herbs
- Braised Kidney Beans & Sweet Potato
- 7-Minute Healthy Sautéed Crimini Mushrooms
- Asian Mushroom Sauté
- Baked Potato with Rosemary, Mushroom Sauce
- Sautéed Mushrooms with Green Peas
- Wild Rice Pilaf

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Mushrooms, Crimini, raw
1.00 cup
72.00 grams

Calories: 16
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
copper	0.36 mg	40	45.5	excellent
selenium	18.72 mcg	34	38.7	excellent
vitamin B2	0.35 mg	27	30.6	excellent
pantothenic acid	1.08 mg	22	24.5	excellent
vitamin B3	2.74 mg	17	19.5	excellent
phosphorus	86.40 mg	12	14.0	excellent
potassium	322.56 mg	9	10.5	very good
zinc	0.79 mg	7	8.2	very good
vitamin B1	0.07 mg	6	6.6	very good
manganese	0.10 mg	5	5.7	very good
vitamin B6	0.08 mg	5	5.3	good
folate	18.00 mcg	5	5.1	good
choline	15.91 mg	4	4.3	good
protein	1.80 g	4	4.1	good
vitamin B12	0.07 mcg	3	3.3	good

World's Healthiest Foods Rating	Rule

excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Mushrooms, shiitake

Long a symbol of longevity in Asia because of their health-promoting properties, shiitake mushrooms have been used medicinally by the Chinese for more than 6,000 years. More recently, their rich, smoky flavor has endeared them to American taste buds. These exotic hearty mushrooms can now be found in supermarket shelves across the U.S. throughout the year.

Like other mushrooms, these specialty mushrooms are as mysteriously unique as they are delicious. While often thought of as a vegetable and prepared like one, mushrooms are actually a fungus, a special type of living organism that has no roots, leaves, flowers or seeds.

What's New and Beneficial about Shiitake Mushrooms

- Although immune system support has often received much of the spotlight in shiitake mushroom research, recent study results involving support of the cardiovascular system have caught the attention of many researchers. In particular, recent studies have shown the ability of shiitake mushrooms to help protect us against cardiovascular diseases (including atherosclerosis) by preventing too much immune cell binding to the lining of our blood vessels. In order for immune cells and other materials to bind onto our blood vessel linings, certain protein molecules—called adhesion molecules—must be produced and sent into action. By helping to block the adhesion molecule production process, substances in shiitake mushrooms can help protect our blood vessels. (The adhesion molecule production that is partially blocked by shiitake mushroom components includes the adhesion molecules ICAM-1, VCAM-1, and E-selectin.)
- Shiitake mushrooms have long been recognized as a very good, non-animal food source of iron. But a recent preliminary study has determined that the bioavailability of iron from shiitake mushrooms may be even better than we thought. Although conducted on laboratory animals (female rats) rather than humans, this study found the iron in dried shiitake mushroom to be equally as bioavailable as supplemental iron in the form of ferrous gluconate. (Ferrous gluconate is a very commonly used low-dose iron supplement.) While we don't usually spotlight research on laboratory animals, we found this result to be especially promising for individuals who consume little or no animal products and are often looking for foods that can supply valuable amounts of bioavailable iron.
- Shiitake mushrooms can be one of the most sustainable foods in your diet! While the majority of shiitake mushrooms produced worldwide have been grown on sawdust block in a non-natural setting, it is fully possible for shiitake mushrooms to be produced on natural hardwood logs in a forest setting. This approach to shiitake mushroom production is called "forest farming" and it has become an especially popular way of growing shiitake mushrooms in the U.S, where there are now more than 200 shiitake mushroom growers. Unfortunately, forest farming is not a requirement for organic certification of shiitake mushrooms. However, all of the plant crop standards in the National Organics Program regulations apply to shiitake mushroom production, and so the combination of these two features—certified organic shiitake mushrooms that have also been forest farmed—can make a great food choice in terms of sustainable agriculture. Just look for the USDA's organic logo on your shiitake mushrooms to determine if they are certified organic. Then check for information about forest farming on the packaging. If no information is provided, there is a good chance that your shiitake mushrooms were not forest farmed. For this reason, we encourage you to ask your store staff or contact the product manufacturer to determine if your shiitake mushrooms were grown on hardwood logs in a natural forest environment.

WHFoods Recommendations

People do not usually consider including mushrooms as part of their meals for their nutritional content. However, shiitake mushrooms are rich in B vitamins—they are an excellent of pantothenic acid, a very good source of vitamin B2, and a good source of vitamin B6, niacin, choline, and folate. Additionally, they are concentrated in minerals, being an excellent source of selenium and copper, a very good source of zinc, and a good source of manganese. They are also a good source of vitamin D (in the D2 form) and dietary fiber. They also provide a wide variety of unique phytonutrients. To maximize their flavor and the retention of their nutrients it is important to not to overcook them. That's why we recommend Healthy Sauteeing shiitake mushrooms for just 7 minutes to bring out their best flavor while maximizing their nutrient retention. For more on our Healthiest Way of Cooking shiitake mushrooms see the How to Enjoy section below.

Mushrooms, Shiitake, cooked
0.50 cup
(72.50 grams)

Calories: 41
GI: not available

Nutrient	DRI/DV
copper	72%

pantothenic acid	52%
selenium	33%
vitamin B2	9%
zinc	9%
manganese	8%
vitamin B6	7%
vitamin B3	7%
choline	6%
fiber	6%
vitamin D	5%
folate	4%

Health Benefits

Shiitake, maitake, and reishi mushrooms are widely referred to as "medicinal mushrooms" due to their long history of medical use, particularly in oriental medicine traditions. It's important to distinguish, however, between extracts and medicinal preparations made from these mushrooms and their appearance as whole foods in an everyday diet. Most of the medicinal research on shiitake mushrooms has been conducted on laboratory animals or on individual cells studied in a laboratory setting. There are hundreds of lab and animal studies that clearly document the medicinal properties of shiitake mushroom extracts. As important as these studies are in a medical context, they are still very different from studies that examine shiitake mushroom as a common and beloved food.

In contrast to the wealth of medicinal research on shiitake mushrooms, there are very few studies on shiitake mushrooms in the human diet. Among the human dietary studies that do exist, however, there is a clear message about shiitake mushrooms: they can provide us with some fantastic health benefits. Below are areas of health support that make the top of our list for shiitake mushrooms when enjoyed as a whole food.

Immune Support

No health benefit is better documented for shiitake mushroom than immune support. In fact, the immune support track record for this mushroom is fascinating. On the one hand, numerous studies have shown the ability of whole shiitake mushrooms to help prevent excessive immune system activity. On the other hand, an equal number of studies have shown the ability of shiitake mushrooms to help stimulate immune system responses under certain circumstances. In other words, from a dietary perspective, shiitake mushrooms appear able to enhance immune function in both directions, giving it a boost when needed, and cutting back on its activity when needed. It's important to note that dietary shiitake mushroom intake—unlike intake of medicinal shiitake extracts—has not been shown to be strongly suppressive of the immune system or strongly activating. From our perspective, this finding makes sense. We wouldn't want our everyday foods to strongly suppress or strongly activate any body system. What we would want from our foods is support of body systems under a variety of circumstances—and that is exactly what we get from shiitake mushrooms with respect to our immune system.

One especially interesting area of immune system support involves the impact of shiitake mushrooms on immune cells called macrophages. Among their many important activities, macrophage cells are responsible for identifying and clearing potentially cancerous cells from the body. In order to carry out this task, they need to be "activated" in a particular way. (In more scientific terms, their activated phenotype needs to reflect a higher level of interleukin 1-beta and tumor necrosis factor alpha, and a lower level of interleukin 10.) Shiitake mushrooms are able to help macrophage cells achieve this activated profile so that they can do a better job clearing potentially cancerous cells. Researchers refer to this result as an "anti-cancer immunity" that is enhanced by shiitake mushroom intake.

The most famous immune-supportive components in shiitake mushrooms are its polysaccharides. (Polysaccharides are large-sized carbohydrate molecules composed of many different sugars arranged in chains and branches.) Although many fungi are well-known for their polysaccharides, no single fungus has been more carefully studied than the shiitake mushroom. We know that this fungus is unique in its variety of polysaccharides, and especially its polysaccharide glucans. (Glucans are polysaccharides in which all of the sugar components involve the simple sugar glucose.) Among the glucans contained in shiitake mushroom are alpha-1,6 glucan, alpha-1,4 glucan, beta-1,3 glucan, beta-1,6 glucan, 1,4-D-glucans, 1,6-D-glucans, glucan phosphate, laminarin, and lentinan. Shiitake mushrooms also contain some important non-glucan polysaccharides, including fucoidans and galactomannins. The immune-related effects of polysaccharides in shiitake mushrooms have been studied on laboratory animals under a wide variety of circumstances, including exercise stress, exposure to inflammation-producing toxins, radiation exposure, and immunodeficiency. Under all of these circumstances, the polysaccharides in shiitake mushrooms have been shown to lessen problems. There is also some evidence that shiitake mushrooms' polysaccharides can help lower total cholesterol levels.

Cardiovascular Benefits

The cardiovascular benefits of shiitake mushrooms have been documented in three basic areas of research. The first of these areas is cholesterol reduction. d-Eritadenine (also called lentinacin, or lentsine, and sometimes abbreviated as DEA) is one of the most unusual naturally occurring nutrients in shiitake mushrooms that has repeatedly been shown to help lower total blood cholesterol. This nutrient is actually derived from adenine—one of the building blocks (nucleotides) in the mushroom's genetic material (DNA). The beta-glucans in shiitake mushrooms are also very likely to contribute to its cholesterol-lowering impact.

Another basic area of cardiovascular support involves the interaction between our cardiovascular system and our immune system. Recent studies have shown that shiitake mushrooms can help protect us against cardiovascular diseases (including atherosclerosis) by preventing too much immune cell binding to the lining of our blood vessels. In order for immune cells and other materials to bind onto our blood vessel linings, certain protein molecules—called adhesion molecules—must be produced and sent into action. By helping to block the adhesion molecule production process, substances in shiitake mushrooms can help protect our blood vessels. (The adhesion molecule production which is partially blocked by shiitake mushroom components includes the adhesion molecules ICAM-1, VCAM-1, and E-selectin.)

A final basic area of cardiovascular benefits involves antioxidant support. Chronic oxidative stress in our cardiovascular system (ongoing, oxygen-based damage to our blood vessel linings) is a critical factor in the development of clogged arteries (atherosclerosis) and other blood vessel problems. One of the best ways for us to reduce our risk of chronic oxidative stress is consumption of a diet rich in antioxidant nutrients. Shiitake mushrooms are a very good source of three key antioxidant minerals: manganese, selenium, and zinc. They also contain some unusual phytonutrient antioxidants. One of the best studied is ergothioneine (ET). This unique antioxidant is derived from the amino acid histidine, although it's unusual since it contains a sulfur group of molecules that are not present in histidine itself. In studies on ET and our cells' oxidative stress levels, one fascinating finding has been the special benefits of ET for cell components called mitochondria. Mitochondria use oxygen to produce energy for the cell. Heart cells have greater concentrations of mitochondria than most any other cell type in the body. For this reason, researchers believe that ET may be one of the key nutrients from shiitake mushrooms that provide us with cardiovascular support.

Anti-Cancer Benefits

Most of the research on shiitake mushrooms and cancer has been conducted on laboratory animals or on individual cells in a laboratory setting and has involved mushroom extracts rather than whole mushrooms in food form. For this reason, our understanding of the anti-cancer benefits of shiitake mushrooms as a whole, natural food is still preliminary. But based on research to date, we believe that adding shiitake mushrooms to your diet is likely to offer you anti-cancer benefits, especially with respect to prevention of prostate cancer, breast cancer, and colon cancer.

Medicinal extracts from shiitake mushrooms have been studied much more extensively than the whole food itself. In cell and laboratory animal experiments, numerous components of shiitake mushrooms have been show to help block tumor growth, sometimes by triggering programmed cell death (apoptosis) in the cancer cells. These components have been collectively referred to as "anti-tumor mycochemicals" provided by shiitake mushrooms. Researchers have speculated that more than 100 different types of compounds in shiitake mushrooms may work together to accomplish these anti-tumor results. While the unique polysaccharides in shiitake mushrooms were first thought to be its primary anti-cancer compounds, scientists are now convinced that shiitake provides many non-polysaccharide substances that have anti-tumor effects.

Other Benefits

The special combination of antioxidants found in shiitake mushrooms together with their highly flexible support for immune system function make them a natural candidate for providing us with protection from a variety of problems involving oxidative stress and immune function. This includes rheumatoid arthritis (RA), an area that has begun to interest shiitake mushroom researchers. Although research in this area is preliminary, we expect to see large-scale human studies confirming the benefits of shiitake mushrooms for prevention of RA.

Medicinal extracts from shiitake mushrooms have well-documented effects on a variety of micro-organisms, including bacteria, fungi, and viruses (including human immunodeficiency virus-1, or HIV-1). While we have yet to see large-scale human studies on whole food intake of shiitake mushrooms and decreased susceptibility to colds, flu or other problems related to unwanted activity of micro-organisms, this is a very likely area for future food research and discovery of health benefits.

Description

Shiitake mushrooms have brown, slightly convex caps that range in diameter from about two to four inches in diameter. They belong to the basidiomycete family of fungi. Until the early 1990's, they were widely known by their scientific genus-species name of *Lentinus edodes*. However, during the late 1980's and early 1990's this genus-species name for shiitake mushrooms was largely phased out and replaced by a new genus-species name, *Lentinula edodes*.

The common name for this mushroom, "shiitake," comes from the Japanese language. "Shii" in Japanese refers to wood belonging to the Pasania species of tree on which shiitake mushrooms naturally grow. "Take" simply translates as "mushroom." You may sometimes also hear shiitake mushroom being referred to as the "Black Forest mushroom," and they do indeed grow naturally in that German mountain range.

Other mushrooms with Asian roots that are also becoming more popular are reishi (*Ganoderma lucidum*) and maitake (*Grifola frondosa*). Reishi mushrooms usually have an antler or rounded, fan shape; the most popular type of reishi is red in color, although that is just one of the six colors in which they grow. Maitake mushrooms grow in a formation of clustered brownish fronds of fan-shaped petals and are commonly known as "Hen of the Woods." These types of mushrooms are available in food markets specializing in Asian foods.

History

Shiitake (as well as reishi and maitake) mushrooms have grown wild since prehistoric times. Their therapeutic value has been prized in Asian countries, where they originated, for thousands of years. They play a critical role in Asian medicinal traditions and were noted in some of the first books on herbal medicine written thousands of years ago. In the past few decades, these mushrooms have become more popular in the United States as a result of an expanding body of scientific research supporting their numerous health benefits. The U.S. is currently home to approximately 200 commercial growers of shiitake mushrooms, and nearly half of those growers use forest farming to produce shiitake mushrooms in a natural forest setting using downed hardwood trees as the cultivation medium.

Although Japan was at one time the world's largest producer of shiitake mushrooms, that distinction now goes to China, which produces over 80% of all commercially sold shiitake mushrooms. Japan, Korea and Taiwan also produce shiitake mushrooms, as does the United States. One quickly growing market for shiitake mushrooms is Brazil, which currently produces more shiitake mushrooms than any other South American country.

How to Select and Store

Shiitake mushrooms are available in many grocery stores throughout the country. If your local store does not carry fresh reishi or maitake mushrooms, investigate the Asian food stores in your area as they oftentimes carry these specialty mushrooms.

Look for mushrooms that are firm, plump and clean. Those that are wrinkled or have wet slimy spots should be avoided.

The best way to store loose shiitake mushrooms (as well as maitake or reishi mushrooms) is to keep them in the refrigerator in a loosely closed paper bag. They will keep fresh for about one week. Dried mushrooms should be stored in a tightly sealed container in either the refrigerator or freezer where they will stay fresh for six months to one year.

How to Enjoy

A Few Quick Serving Ideas

- Shiitake mushrooms are traditionally added to miso soup.
- Healthy saute mushrooms with onions and garlic. Serve as a side dish or as a topping for chicken, beef, lamb or venison.
- To give your vegetable stock an extra depth, add dried shiitake mushrooms.
- For a quick and easy Asian pasta dish, healthy saute shiitake mushrooms with snap peas and tofu. Season to taste and serve over buckwheat soba noodles (or your favorite type of pasta).

WHFoods Recipes That Feature Shiitake Mushrooms

- Poached Eggs Over Collard Greens & Shiitake Mushrooms
- 5 Spice Onion Soup
- Shiitake Mushroom Seaweed Soup
- 15-Minute Steamed Halibut with Bok Choy

- 15 Minute Healthy Sauteed Chicken & Bok Choy
- 5-Spice Chicken in a Bowl
- Miso Stir-Fry
- Spicy Healthy Sautéed Tofu
- Spicy Vegetable Tart
- Asian Mushroom Saute
- Healthy Sautéed Shiitake Mushrooms

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Mushrooms, Shiitake, cooked
0.50 cup
72.50 grams

Calories: 41
GI: not available

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
copper	0.65 mg	72	32.0	excellent
pantothenic acid	2.61 mg	52	23.1	excellent
selenium	17.98 mcg	33	14.5	excellent
vitamin B2	0.12 mg	9	4.1	very good
zinc	0.96 mg	9	3.9	very good
manganese	0.15 mg	8	3.3	good
vitamin B6	0.12 mg	7	3.1	good
vitamin B3	1.09 mg	7	3.0	good
choline	26.68 mg	6	2.8	good
fiber	1.52 g	6	2.7	good
vitamin D	20.30 IU	5	2.2	good
folate	15.22 mcg	4	1.7	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Mustard greens

What's New and Beneficial About Mustard Greens

- The cholesterol-lowering ability of steamed mustard greens is second only to steamed collard greens and steamed kale in a recent study of cruciferous vegetables and their ability to bind bile acids in the digestive tract. When bile acid binding takes place, it is easier for the bile acids to be excreted from the body. Since bile acids are made from cholesterol, the net impact of this bile acid binding is a lowering of the body's cholesterol level. It's worth noting that steamed mustard greens (and all steamed forms of the cruciferous vegetables) show much greater bile acid binding ability than raw mustard greens.
- For total glucosinolate content, mustard greens rank high on the list of commonly eaten cruciferous vegetables, and in one study, were second only to Brussels sprouts in terms of total glucosinolate content. Glucosinolates are phytonutrients that provide us with unique health benefits because they can be converted into isothiocyanates (ITCs) that have cancer-preventive properties. All cruciferous vegetables have long been known to contain glucosinolates, but it's recent research that's made us realize how valuable mustard greens are in this regard.
- The cancer protection we get from mustard greens may be largely related to two special glucosinolates found in this cruciferous vegetable: sinigrin and gluconasturtiian. Sinigrin can be converted into allyl-isothiocyanate (AITC) and gluconasturtiian can be converted into phenethyl-isothiocyanate (PEITC). Both AITC and PEITC have well-documented cancer-preventive and anti-inflammatory properties.

WHFoods Recommendations

You'll want to include mustard greens as one of the cruciferous vegetables you eat on a regular basis if you want to receive the fantastic health benefits provided by the cruciferous vegetable family. At a minimum, include cruciferous vegetables as part of your diet 2-3 times per week, and make the serving size at least 1-1/2 cups. Even better from a health standpoint, enjoy mustard greens and other vegetables from the cruciferous vegetable group 4-5 times per week and increase your serving size to 2 cups.

We recommend Healthy Sautéeing mustard greens rather than using the more traditional methods of boiling or steaming mustard greens. Healthy Sauté helps to keep them from getting soft and watery and retains their flavor. Chop mustard greens and let them sit for at least 5 minutes to enhance their health-promoting benefits before cooking. See Healthiest Way of Cooking Mustard Greens in the How to Enjoy section below.

Mustard Greens, cooked
1.00 cup
(140.00 grams)

Calories: 36
GI: very low

Nutrient	DRI/DV
vitamin K	922%
vitamin A	96%
vitamin C	47%
copper	22%
manganese	19%
calcium	17%
vitamin E	17%
fiber	11%
vitamin B6	8%
phosphorus	8%
iron	7%
vitamin B2	7%
protein	7%
potassium	6%
magnesium	5%
vitamin B1	5%
vitamin B3	4%
pantothenic acid	3%
folate	3%

Health Benefits

Unlike some of their fellow cruciferous vegetables, mustard greens have not been the direct focus of most health-oriented research studies. However, mustard greens have sometimes been included in a longer list of cruciferous vegetables that have been lumped together and studied to determine potential types of health benefits. Based upon several dozen studies involving cruciferous vegetables as a group (and including mustard greens on the list of vegetables studied), cancer prevention appears to be a standout area for mustard greens when summarizing health benefits.

This connection between mustard greens and cancer prevention should not be surprising since mustard greens provide special nutrient support for three body systems that are closely connected with cancer development as well as cancer prevention. These three systems are (1) the body's detox system, (2) its antioxidant system, and (3) its inflammatory/anti-inflammatory system. Chronic imbalances in any of these three systems can increase risk of cancer, and when imbalances in all three systems occur simultaneously, the risk of cancer increases significantly. Among all types of cancer, prevention of the following cancer types is most closely associated with intake of mustard greens: bladder cancer, breast cancer, colon cancer, lung cancer, prostate cancer, and ovarian cancer.

Detox Support Provided by Mustard Greens

The detox support provided by mustard greens includes antioxidant nutrients to boost Phase 1 detoxification activities and sulfur-containing nutrients to boost Phase 2 activities. Mustard greens also contain phytonutrients called glucosinolates that can help activate detoxification enzymes and regulate their activity. At least three key glucosinolates have been clearly identified in mustard greens in significant amounts: sinigrin, gluconasturtiian, and glucotropaeolin.

If we fail to give our body's detox system adequate nutritional support, yet continue to expose ourselves to unwanted toxins through our lifestyle and our dietary choices, we can place our bodies at increased risk of toxin-related damage that can eventually increase our cells' risk of becoming cancerous. That's one of the reasons it's so important to bring mustard greens and other cruciferous vegetables into our diet on a regular basis.

The Antioxidant Benefits of Mustard Greens

As an excellent source of vitamin C, vitamin E, vitamin A (in the form of carotenoids), and manganese, mustard greens give us high level support for four conventional antioxidant nutrients. But the antioxidant support provided by mustard greens extends far beyond these conventional nutrients and into the realm of phytonutrients. Hydroxycinnamic acid, quercetin, isorhamnetin, and kaempferol are among the key antioxidant phytonutrients provided by mustard greens. This broad spectrum antioxidant support helps lower the risk of oxidative stress in our cells. Chronic oxidative stress—meaning chronic presence of overly reactive oxygen-containing molecules and cumulative damage to our cells by these molecules—is a risk factor for development of most cancer types. By providing us with a diverse array of antioxidant nutrients, mustard greens help lower our cancer risk by helping us avoid chronic and unwanted oxidative stress.

Mustard Greens' Anti-inflammatory Benefits

As an excellent source of vitamin K, mustard greens provide us with great amounts of a hallmark anti-inflammatory nutrient. Vitamin K acts as a direct regulator of our inflammatory response. While glucobrassicin (a glucosinolate found in many cruciferous vegetables, and the precursor for the anti-inflammatory molecule indole-3-carbinol) does not appear to be present in mustard greens in significant amounts, other glucosinolates present in mustard greens may provide important anti-inflammatory benefits and are the subject of current research.

Like chronic oxidative stress and chronic weakened detox ability, chronic unwanted inflammation can significantly increase our risk of cancers and other chronic diseases (especially cardiovascular diseases).

Mustard Greens and Cardiovascular Support

Researchers have looked at a variety of cardiovascular problems—including heart attack, ischemic heart disease, and atherosclerosis—and found preliminary evidence of an ability on the part of cruciferous vegetables to lower our risk of these health problems. Yet regardless of the specific cardiovascular problem, it is one particular type of cardiovascular benefit that has most interested researchers, and that benefit is the anti-inflammatory nature of mustard greens and their fellow cruciferous vegetables. Scientists have not always viewed cardiovascular problems as having a central inflammatory component, but the role of unwanted inflammation in creating problems for our blood vessels and circulation has become increasingly fundamental to an understanding of cardiovascular diseases. While glucoraphanin (a glucosinolate found in many cruciferous vegetables, and the precursor for sulforaphane, an isothiocyanate with important anti-inflammatory properties) does not appear to be present in mustard greens in significant amounts, other glucosinolates present in mustard greens may provide important anti-inflammatory benefits and are the subject of current research.

A second area you can count on mustard greens for cardiovascular support involves their cholesterol-lowering ability. Our liver uses cholesterol as a basic building block to product bile acids. Bile acids are specialized molecules that aid in the digestion and absorption of fat through a process called emulsification. These molecules are typically stored in fluid form in our gall bladder, and when we eat a fat-containing meal, they get released into the intestine where they help ready the fat for interaction with enzymes and eventual absorption up into the body. When we eat mustard greens, fiber-related nutrients in this cruciferous vegetable bind together with some of the bile acids in the intestine in such a way that they simply stay inside the intestine and pass out of our body in a bowel movement, rather than getting absorbed along with the fat they have emulsified. When this happens, our liver needs to replace the lost bile acids by drawing upon our existing supply of cholesterol, and as a result, our cholesterol level drops down. Mustard greens provide us with this cholesterol-lowering benefit whether they are raw or cooked. However, a recent study has shown that the cholesterol-lowering ability of raw mustard greens improves significantly when they are steamed. In fact, when the cholesterol-lowering ability of steamed mustard greens was compared with the cholesterol-lowering ability of the prescription drug cholestyramine (a medication that is taken for the purpose of lowering cholesterol), mustard greens bound 34% as many bile acids (based on a standard of comparison involving total dietary fiber).

Description

All cruciferous vegetables provide integrated nourishment across a wide variety of nutritional categories and provide broad support across a wide variety of body systems as well. For more on cruciferous vegetables see:

- Eating Healthy with Cruciferous Vegetables
- Feeling Great with Cruciferous Vegetables

Spunky and soulful describe the taste of mustard greens that add a pungent, peppery flavor to recipes in which they are featured. Although they are available throughout the year, they are in season from December through April when they are at their best and most readily available.

Mustard greens are the leaves of the mustard plant, *Brassica juncea*. Mustard greens come in a host of varieties that each has distinct characteristics. Adding these brilliant leaves to your food preparations will certainly enhance the beauty of any meal. Most mustard greens are actually emerald green in color, while some are not green at all but rather shades of dark red or deep purple. The leaves of mustard greens can have either a crumpled or flat texture and may have either toothed, scalloped, frilled, or lacey edges. Mizuna is one type of mustard green that is oftentimes available in stores. In addition to providing wonderfully nutritious greens, this plant also produces the acrid-tasting brown seeds that are used to make Dijon mustard.

History

Mustard greens originated in the Himalayan region of India and have been grown and consumed for more than 5,000 years. Mustard greens are a notable vegetable in many different cuisines, ranging from Chinese to Southern American. Like turnip greens, they may have become an integral part of Southern cuisine during the times of slavery, serving as a substitute for the greens that were an essential part of Western African foodways. While India, Nepal, China and Japan are among the leading producers of mustard greens, a significant amount of mustard greens are grown in the United States as well.

How to Select and Store

Purchase mustard greens that are unblemished and free from any yellowing or brown spots. They should look fresh and crisp and be a lively green color.

Place mustard greens in a plastic bag, removing as much of the air from the bag as possible. Store in the refrigerator where they should keep fresh for about three to four days.

How to Enjoy

A Few Quick Serving Ideas

- Young mustard greens make great additions to salads.

- Serve healthy sautéed mustard greens with walnuts.
- Adding chopped mustard greens to a pasta salad gives it a little kick. One of our favorite combinations is chopped tomatoes, pine nuts, goat cheese, pasta, and mustard greens tossed with a little olive oil.

WHFoods Recipes That Feature Mustard Greens

- Curried Mustard Greens & Garbanzo Beans with Sweet Potatoes

Safety

Mustard Greens and Goitrogens

You may sometimes hear mustard greens being described as a food that contains "goitrogens," or as a food that is "goitrogenic." For helpful information in this area—including our WHFoods Recommendations—please see our article What is meant by the term "goitrogen" and what is the connection between goitrogens, food, and health?.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Mustard Greens, cooked **1.00 cup** **140.00 grams**				**Calories: 36** **GI: very low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin K	829.78 mcg	922	455.9	excellent
vitamin A	865.90 mcg RAE	96	47.6	excellent
vitamin C	35.42 mg	47	23.4	excellent
copper	0.20 mg	22	11.0	excellent
manganese	0.38 mg	19	9.4	excellent
vitamin E	2.49 mg (ATE)	17	8.2	excellent
calcium	165.20 mg	17	8.2	excellent
fiber	2.80 g	11	5.5	very good
phosphorus	58.80 mg	8	4.2	very good
vitamin B6	0.14 mg	8	4.1	very good
protein	3.58 g	7	3.5	very good
vitamin B2	0.09 mg	7	3.4	very good
iron	1.22 mg	7	3.4	very good
potassium	226.80 mg	6	3.2	good
vitamin B1	0.06 mg	5	2.5	good
magnesium	18.20 mg	5	2.2	good
vitamin B3	0.61 mg	4	1.9	good
pantothenic acid	0.17 mg	3	1.7	good
folate	12.60 mcg	3	1.6	good

World's Healthiest Foods Rating	**Rule**
	DRI/DV>=75% OR

excellent	Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Olive oil, extra virgin

Anyone coming from the Mediterranean region of the world would tell you about the health benefits, as well as the wonderful flavor, of a good dose of olive oil on salads, pasta, fish and almost anything else. Fortunately, it is available throughout the year to satisfy taste buds and promote good health.

What's New and Beneficial about Extra Virgin Olive Oil

- The quality of olive oil production—especially the stage of pressing—really does make a difference when it comes to health benefits. Recent studies have compared the anti-inflammatory benefits of extra virgin olive oil (EVOO) obtained from the first pressing of the oil to the anti-inflammatory benefits of virgin olive oils (non-EVOO) obtained from later pressings. What researchers found was an ability of EVOO to lower inflammatory markers in the blood when non-EVOOs were unable to do so. (Study measurements included blood levels of thromboxane A2, or TXA2, and leukotriene B2, or LBT2.) This ability of extra virgin olive oil to help protect against unwanted inflammation is not surprising, since EVOO is known to contain stronger concentrations of phytonutrients (especially polyphenols) that have well-known anti-inflammatory properties.
- Mediterranean Diet studies have long associated olive oil intake with decreased risk of heart disease. However, a recent group of studies has provided us with a fascinating explanation of olive oil's cardioprotective effect. One of the key polyphenols in olive oil—hydroxytyrosol (HT)—helps protect the cells that line our blood vessels from being damaged by overly reactive oxygen molecules. HT helps protect the blood vessel cells by triggering changes at a genetic level. The genetic changes triggered by HT help the blood vessel cells to enhance their antioxidant defense system. In other words, olive oil supports our blood vessels not only by providing antioxidants like like vitamin E and beta-carotene. Olive oil also provides our blood vessels with unique molecules like HT that actually work at a genetic level to help the cellular walls of the blood vessels remain strong.
- Olive oil has long been recognized for its high percentage of monounsaturated fat. This plant contains between 70-85% of its fat in the form of oleic acid - a monounsaturated, omega-9 fatty acid. As a concentrated source of monounsaturated fat, olive oil actually has some good company in the plant oil department. Three increasingly popular plant oils that immediate come to mind in this respect are high-oleic safflower oil, high-oleic sunflower oil, and avocado oil. The total fat content in each of these oils can rise to 70% or more in terms of monounsaturated fat. (Canola oil usually drops this percentage one step lower, with its monounsaturated fat content typically falling into the 60-65% range. And some popular plant oils drop the monounsaturated fat content down a lot more. Corn oil, for example, is usually 25-30% monounsaturated, and coconut oil is even lower at 5-7%.)

  When diets low in monounsaturated fat are altered to increase the monounsaturated fat content (by replacing other oils with olive oil), research study participants tend to experience a significant decrease in their total blood cholesterol, LDL cholesterol, and LDL:HDL ratio. Recent research studies have taken these heart-healthy effects of olive oil one step further. Olive oil's monounsaturated fat content (specifically, its high level of oleic acid) has now been determined to be a mechanism linking olive oil intake to decreased blood pressure. Researchers believe that the plentiful amount of oleic acid in olive oil gets absorbed into the body, finds its way into cell membranes, changes signaling patterns at a cell membrane level (specifically, altering G-protein associated cascades) and thereby lowers blood pressure. To our knowledge, this is the first time that the monounsaturated fat content of olive oil has been linked not only to cholesterol reduction, but also to reduction of blood pressure.

- Cancer prevention has been one of the most active areas of olive oil research, and the jury is no longer out on the health benefits of olive oil with respect to cancer. Twenty-five studies on olive oil intake and cancer risk—including most of the large-scale human studies conducted up through the year 2010—have recently been analyzed by a team of researchers at the Mario Negri Institute for Pharmacological Research Institute in Milan, Italy. Firmly established by this research team were the risk-reducing effects of olive oil intake with respect to cancers of the breast, respiratory tract, upper digestive tract and, to a lesser extent, lower digestive tract (colorectal cancers). These anti-cancer benefits of olive oil became most evident when the diets of routine olive oil users were compared with the diets of individuals who seldom used olive oil and instead consumed diets high in saturated added fat, especially butter.

Olive Oil, cold pressed extra virgin
1.00 TBS
(13.50 grams)

Calories: 119
GI: very low

Nutrient	DRI/DV
vitamin E	13%

Health Benefits

Thanks to its status as a spotlight food in the Mediterranean Diet, and thanks to extensive research on its unique phytonutrient composition, olive oil has become a legendary culinary oil with very difficult-to-match health benefits. Among its extensive list of phytonutrients, no single category of nutrients is more important than its polyphenols. The polyphenol content of this delicious oil is truly amazing! The list below shows some of the key polyphenols found in olive oil, organized by their chemical category:

- Simple Phenols
    - tyrosol
    - hydroxytyrosol
- Terpenes
    - oleuropein
    - ligstroside
- Flavones
    - apigenin
    - luteolin
- Hydroxycinnamic acids
    - caffeic acid
    - cinnamic acid
    - ferulic acid
    - coumaric acid
- Anthocyanidins
    - cyanidins
    - peonidins
- Flavonols
    - quercetin
    - kaempferol
- Flavonoid glycosides
    - rutin
- Lignans
    - pinoresinol
- Hydroxybenzoic acids
    - vanillic acid
    - syringic acid

Most of the polyphenols in this list have been shown to function both as antioxidants and also as anti-inflammatory nutrients in the body. The very number and variety of polyphenols in olive oil helps explain the unique health benefits of this culinary oil.

Anti-Inflammatory Benefits

It's unusual to think about a culinary oil as an anti-inflammatory food. Plant oils are nearly 100% fat, and in a general dietary sense, they are typically classified as "added fats." Intake of too much added dietary fat can be a problem for many reasons—including reasons involving unwanted inflammation. So it's pretty remarkable to find a culinary oil that's repeatedly been shown to have anti-inflammatory properties and provide health benefits in the area of unwanted inflammation. Yet that's exactly the research track record that describes extra virgin olive oil.

The anti-inflammatory strength of olive oil rests on its polyphenols. These anti-inflammatory compounds include at least nine different categories of polyphenols and more than two dozen well-researched anti-inflammatory nutrients. Research has documented a wide variety of anti-inflammatory mechanisms used by olive oil polyphenols to lower our risk of inflammatory problems. These mechanisms include decreased production of messaging molecules that would otherwise increase inflammation (including TNF-alpha, interleukin 1-beta, thromboxane B2, and leukotriene B4); inhibition of pro-inflammatory enzymes like cyclo-oxygenase 1 and cyclo-oxygenase 2; and decreased synthesis of the enzyme inducible nitric oxide synthase.

In heart patients, olive oil and its polyphenols have also been determined to lower blood levels of C-reactive protein (CRP), a widely used blood measurement for assessing the likelihood of unwanted inflammation. They have also been found to reduce activity in a metabolic pathway called the arachidonic acid pathway, which is central for mobilizing inflammatory processes.

These anti-inflammatory benefits of extra virgin olive oil do not depend on large levels of intake. As little as 1-2 tablespoons of extra virgin olive oil per day have been shown to be associated with significant anti-inflammatory benefits.

Cardiovascular Benefits

Many different cardiovascular problems—including gradual blocking of the arteries and blood vessels (called atherosclerosis)—have their origin in two unwanted circumstances. The first of these circumstances is called oxidative stress. Oxidative stress means too much damage (or risk of damage) from the presence of overly reactive oxygen-containing molecules. One of the best ways to help avoid oxidative stress is to consume a diet that is rich in antioxidant nutrients. The second of these circumstances is ongoing (chronic) and undesirable low-level inflammation. Undesirable and chronic inflammation can result from a variety of factors, including unbalanced metabolism, unbalanced lifestyle, unwanted exposure to environmental contaminants, and other factors. One of the best ways to help avoid chronic and unwanted inflammation is to consume a diet that is rich in anti-inflammatory nutrients. Any food that is rich in antioxidant and anti-inflammatory nutrients is a natural candidate for lowering our risk of heart problems, because it contains the exactly right combination of nutrients to lower our risk of oxidative stress and chronic, unwanted inflammation. Many foods contain valuable amounts of antioxidants and anti-inflammatory compounds, but few foods are as rich in these compounds as extra virgin olive oil, and this fact alone accounts for many of the research-based benefits of this culinary oil for health of our cardiovascular system.

In terms of antioxidant protection for our blood vessels, olive oil has been shown to lower risk of lipid peroxidation (oxygen damage to fat) in our bloodstream. Many of the fat-containing molecules in our blood—including molecules like LDL—need to be protected from oxygen damage. Oxygen damage to molecules like LDL significantly increases our risk of numerous cardiovascular diseases, including atherosclerosis. Protection of the LDL molecules in our blood from oxygen damage is a major benefit provided by olive oil and its polyphenols. Equally important is protection against oxygen damage to the cells that line our blood vessels. Once again, it's the polyphenols in olive oil that have been shown to provide us with that protection.

One process we don't want to see in our blood vessels is too much clumping together of blood cells called platelets. While we want to see blood platelets clump together under circumstances like an open wound, where their clumping together acts to seal off the wound, we don't want this process to occur in an ongoing way when there is no acute emergency. Several of the polyphenols found in olive oil—including hydroxytyrosol, oleuropein and luteolin—appear to be especially helpful in keeping our blood platelets in check and avoiding problems of too much clumping (called platelet aggregation). There are also two messaging molecules (called plasminogen activator inhibitor-1 and factor VII) that are capable of triggering too much clumping together of the platelets, and the polyphenols in olive oil can help stop overproduction of these molecules.

Olive oil is one of the few widely used culinary oils that contains about 75% of its fat in the form of oleic acid (a monounsaturated, omega-9 fatty acid). Research has long been clear about the benefits of oleic acid for proper balance of total cholesterol, LDL cholesterol, and HDL cholesterol in the body. When diets low in monounsaturated are made high in monounsaturated fat (by replacing other oils with olive oil), research study participants tend to experience a significant decrease in their total blood cholesterol, LDL cholesterol, and LDL:HDL ratio. Those are exactly the results we want for heart health. In addition to these cholesterol-balancing effects of olive oil and its high oleic acid content, however, comes a new twist: recent research studies have shown that olive oil and its oleic acid may be important factors for lowering blood pressure. Researchers believe that the plentiful amount of oleic acid in olive oil gets absorbed into the body, finds its way into cell membranes, changes signaling patterns at a cell membrane level (specifically, altering G-protein associated cascades) and thereby lowers blood pressure.

Interestingly, a recent laboratory animal study adds one note of caution for anyone wanting to bring the unique cardiovascular benefits of olive oil into their diet. This study found that cardiovascular benefits from olive oil and its polyphenols were not realized when the laboratory animals consumed too many calories and too much total food. This result suggests that olive oil—outstanding as it is in polyphenol protection of our cardiovascular system—needs to be integrated into an overall healthy diet in order to provide its expected benefits.

Digestive Health Benefits

Benefits of olive oil for the digestive tract were first uncovered in research on diet and cancers of the digestive tract. Numerous studies found lower rates of digestive tract cancers—especially cancers of the upper digestive tract, including the stomach and small intestine—in populations that regularly consumed olive oil. Studies on the Mediterranean Diet were an important part of this initial research on olive oil and the digestive tract. Protection of the lower digestive tract (for example, protection of the colon from colon cancer) is less well-documented in the olive oil research, even though there is some strongly supportive evidence from select laboratory animal studies. Many of these anti-cancer effects in the digestive tract were believed to depend on the polyphenols in olive oil and their antioxidant plus anti-inflammatory properties. One particular category of polyphenols, called secoiridoids, continues to be a focus in research on prevention of digestive tract cancers.

Recent research has provided us with even more information, however, about olive oil, its polyphenols, and protection of the digestive tract. One fascinating area of recent research has involved the polyphenols in olive oil and the balance of bacteria in our digestive tract. Numerous polyphenols in olive oil have been shown to slow the growth of unwanted bacteria, including bacteria commonly responsible for digestive tract infections. These polyphenols include oleuropein, hydroxytyrosol, and tyrosol. Some of these same polyphenols—along with other olive oil polyphenols like ligstroside—are specifically able to inhibit the growth of the *Helicobacter pylori* bacterium. This effect of the olive oil polyphenols may be especially important, since overpopulation of *Helicobacter* bacteria coupled with over-attachment of Helicobacter to the stomach lining can lead to stomach ulcer and other unwanted digestive problems.

Bone Health Benefits

Support of overall bone health is another promising area of olive oil research. While most of the initial study in this area has been conducted on laboratory animals, better blood levels of calcium have been repeatedly associated with olive oil intake. In addition, at least two polyphenols in olive oil—tyrosol and hydroxytyrosol—have been shown to increase bone formation in rats. A recent group of researchers has also suggested that olive oil may eventually prove to have special bone benefits for post-menopausal women, since they found improved blood markers of overall bone health in female rats who had been fed olive oil after having their ovaries removed. Taken as a group, the above studies suggest that bone health benefits may eventually be viewed as an important aspect of olive oil intake.

Cognitive Benefits

Improved cognitive function—especially among older adults—is a well-known feature of the Mediterranean Diet. As the staple oil in that diet, olive oil has been of special interest for researchers interested in diet and cognitive function. In France, a recent study large-scale study on older adults has shown that visual memory and verbal fluency can be improved with what the researchers called "intensive use" of olive oil. In this case, "intensive use" meant regular use of olive oil not just for cooking, or as an ingredient in sauces and dressings, but in all of these circumstances.

Equally fascinating to us in the area of cognition has been recent research on olive oil intake and brain function. In laboratory animals with brain function that had been compromised by lack of oxygen, consumption of olive oil helped offset many different types of brain-related problems, including unbalanced water content, unbalanced nervous system activity, and too easy passage of molecules across the blood brain barrier. This animal research has given scientists many further clues about the ways in which olive oil might provide us with cognitive benefits. The ability to help protect our brain during times of imbalance may turn out to be one of the special health benefits offered by this unique culinary oil.

Anti-Cancer Benefits

The polyphenols found in olive oil are a natural for helping us lower our risk of certain cancer types. Many types of cancer only get initiated when cells are overwhelmed by oxidative stress (damage to cell structure and function by overly reactive oxygen-containing molecules) and by chronic excessive inflammation. Since the polyphenols in olive oil act both as antioxidants and anti-inflammatory molecules, they are perfectly suited for lowering our cells' risk of oxidative stress and chronic unwanted inflammation. Research studies have shown that as little as 1-2 tablespoons of olive oil per day can lower our risk of certain cancer types, including cancers of the breast, respiratory tract, upper digestive tract, and to a lesser extent, lower digestive tract (colorectal cancers). In some research studies, the anti-cancer benefits of olive oil do not show up until the diets of routine olive oil users are compared with the diets of individuals who seldom use olive oil and who instead consume added fats that are more saturated in composition (for example, butter).

While most of the anti-cancer research on olive oil has focused on its polyphenols and their antioxidant and anti-inflammatory properties, several studies have uncovered other fascinating ways in which olive oil provides its anti-cancer benefits. These other ways include the improvement of cell membrane function in a way that lowers risk of cancer development and the altering gene expression in cells in a way that enhances their antioxidant defense system. A final important mechanism linking olive oil intake to decreased cancer risk involves protection of our DNA. The antioxidants in olive oil appear to have a special ability to protect DNA (deoxyribonucleic acids)—the key chemical component of genetic material in our cells—from oxygen damage. DNA protection from unwanted oxidative stress means better cell function in wide variety of ways and provides a cell with decreased risk of cancer development.

There is also encouraging research on the potential for olive oil to help with control of certain cancers once they have already developed. For example, improvement of breast cancer status has been an area of particular interest in olive oil research. Here some of the research has focused on the secoiridoids in olive oil (especially oleocanthal), and its ability to help keep breast cancer cells from reproducing. Another example involves the ability of hydroxytyrosol (HT) in olive oil to trigger programmed cell death (apoptosis) in colon cancer cells. HT may be able to accomplish this anti-cancer effect by helping block the enzymatic activity of fatty acid synthetase (FAS). These cancer-controlling properties of olive oil and olive oil constituents are generally referred to as the "antiproliferative" properties of olive oil. We expect to see more future research in this area.

Description

Olive oil is made from the crushing and then subsequent pressing of olives. The fact that olives are rich in oil is reflected in the botanical name of the olive tree—*Olea europea*—since the word "oleum" means oil in Latin. Olive oil is available in a variety of grades, which reflect the degree to which it has been processed. Extra virgin olive oil is derived from the first pressing of the olives and has the most delicate flavor and strongest overall health benefits. See How to Select and Store for more information on these different grades of olive oil.

History

Olives, one of the oldest foods known, are thought to have originated in Crete or Syria between five and seven thousand years ago. Since ancient times, the olive tree has provided food, fuel, timber and medicine for many civilizations, and has been regarded as a symbol of peace and wisdom. The venerable oil of the olive has been consumed since as early as 3,000 B.C.

It's not clear exactly how olive trees arrived in the U.S., but it's clear that the time frame was much later, during the 1500-1700's. Spanish colonizers of North America definitely brought olive trees across the Atlantic Ocean during the 1500-1700's, and while some may have been brought directly to the region which is now California, olive trees may also have been brought to the region from Mexico, where cultivation by the Spanish was already underway.

Olive oil has been and still is a staple in the diet of many Mediterranean countries. The recent discovery that the Mediterranean diet, which features this prized oil, may be linked to a reduced risk of heart disease and other health conditions has caused olive oil to become very popular in the United States in the past few decades. Today, much of the commercial cultivation of olive oil is still centered in the Mediterranean region in such countries as Spain (36% of total production), Italy (25%), and Greece (18%). These countries—along with the remaining European countries—also consume about two-thirds of all olive oil that is produced. Regions of the world with quickly-increasing consumption and production of olive oil include South America (especially Chile) and Australia.

How to Select and Store

Since olive oil can become rancid from exposure to light and heat, there are some important purchasing criteria you should follow to ensure buying a better quality product. Look for olive oils that are sold in dark tinted bottles since the packaging will help protect the oil from oxidation caused by exposure to light. In addition, make sure the oil is displayed in a cool area, away from any direct or indirect contact with heat.

When you shop for olive oil, you will notice a host of different grades are available, including extra-virgin, virgin, refined and pure:

- Extra virgin olive oil (EVOO) is the unrefined oil derived from the first pressing of the olives and has the most delicate flavor
- Virgin olive oil is also derived from the first pressing of the olives but has a higher acidity level than extra virgin olive oil (as well as lower phytonutrient levels and a less delicate taste). According to the standards adopted by the International Olive Council (IOC), "virgin" can contain up to 2% free acidity (expressed as oleic acid), while "extra virgin" can only contain up to 0.8% of free acidity.

  It is important to note, however, that acidity is by no means the only difference between EVOO and other grades of olive oil. In fact, a sizeable amount of controversy has arisen within the olive oil industry over key characteristics of EVOO and the extent to which these characteristics are present in commercial products. Since over 90% of all EVOO consumed in the United States is imported, many evaluators of EVOO have looked to the International Olive Council (IOC) headquartered in Madrid, Spain for quality criteria in evaluating EVOO. However, unlike Italy, Spain, Greece, Portugal, and other European Union countries that were founding members of the IOC, the United States has never become an official IOC member country or adopted IOC standards for EVOO as its own mandatory standards.

  In the United States, voluntary standards for olive oil have traditionally been set by the U.S. Department of Agriculture (USDA), which in 2010 did update its own standards to more closely resemble IOC standards in terms of EVOO chemistry. However, even though most IOC chemical standards like percent free acidity were adopted by the USDA, some differences remain between IOC and USDA chemical criteria. (In addition, since 2010, the IOC has gone on to update and revise some of its chemical standards, and these changes are not reflected in the existing USDA criteria.) But a perhaps even bigger part of the controversy over EVOO standards has not involved chemical criteria like percent free acidity but rather sensory criteria (also called "organoleptic" criteria) like taste and aroma. If you consider olive oil as falling into the category of a fresh fruit juice (in the sense that an olives actually belong to a special group of fruits called "drupes" and can be pressed to obtain their oil or "juice"), aroma and taste might be considered as defining characteristics of this food. Assurance of excellent taste and aroma is a more difficult regulatory standard than assurance of a chemical standard like percent free acidity, and to some extent may require closer monitoring of local conditions and plant varieties. In this context, several organizations in the U.S. offer their own quality seal for EVOO, including the California Olive Oil Council (COOC) and the North American Olive Oil Association (NAOOA). Quality seals from these organizations can help provide assurance about EVOO quality.

Similar organizations exist in Europe and can be helpful for assuring EVOO quality. In most cases, your best bet is to look for specific initials on the olive oil container that represent official review and sanctioning by these organizations. Among your options here are the designations "A.O.C." or "D.O.P." or "D.P.O." or "D.O." "A.O.C." stands for the French term "Appellation D'origine Controlée." "D.O.P." stands for the Italian "Denominazione d'Origine Protetta" (note that D.O.P. is also written as "D.P.O." in some other European countries). In Spain, a similar designation is "D.O." which stands for "Denominacion de Origen." Any of these initials can help provide assurance of quality with respect to extra virgin olive oils.

- "Pure olive oil" is a phrase that is somewhat confusing, and perhaps also somewhat misleading. If you see the term "pure" on the label of an olive oil container, it typically means that the oil is a blend of refined and unrefined virgin olive oils. "Refined olive oil" is obtained from unrefined virgin olive oils, and it's only allowed to contain up to 0.3% of free acidity. However, while lower in free acidity than extra virgin or virgin olive oils, refined olive oil loses some of its unique nutrient content through the refining process. For this reason, we recommend the purchase of extra virgin olive oil over all other olive oil types, including "pure olive oil."

Another term that you may see on a bottle of olive oil is "cold pressed." This term means that very minimal heating (and by IOC standards, under 81F/27C) was used when mechanically processing the olives to obtain their oil. We like the idea of cold pressed extra virgin olive oil, because we believe that minimal use of heating, combined with the phytonutrient-rich first pressing of the oil, provides the strongest possible nutrient composition from an extracted oil.

Proper storage techniques for olive oil are very important, not only to preserve the delicate taste of the oil, but also to ensure that it does not spoil and become rancid, which will have a negative effect on its nutritional profile.

Even though olive oil's monounsaturated fats are more stable and heat-resistant than the polyunsaturated fats that predominate in other oils (especially the easily damaged omega-3 fatty acids found in flax seed oil, which should always be refrigerated and never heated), olive oil should be stored properly and used within 1-2 months to ensure its healthy phytonutrients remain intact and available. Research studies have shown compromise in the nutritional quality of olive oil after two months' period of time, even when the oil was properly stored.

Proper storage of olive oil includes protection from light. There is debate about the ideal type of storage container. Tinted glass bottles are one of the best storage options for preventing unwanted contamination of the olive oil with packaging materials (as might occur, for example, with the use of dark plastic bottles in which very small amounts of plastic might migrate from the bottle into the oil). However, depending upon the degree and type of glass tinting, exposure to all light might not be prevented with the use of tinted glass. Metal containers for olive oil storage are also an option, although it is unclear about the potential for olive oil to be affected by the metal elements in the container. The transfer of olive oil to a sealed ceramic container is also an option. If you decide to purchase olive oil in a tinted glass bottle, we recommend that you store it in a lightproof area, like a cabinet with solid doors or closed pantry. If you decide to purchase in either plastic or metal containers, you may want to take the additional step of moving the oil into a ceramic container that can be sealed. If you aren't sure how quickly you will be using your olive oil, you may want to buy it in small-size amounts to avoid the problems that can arise with longer-term storage.

Purchase only as much as you will use in one to two months and store away from light and heat. Protect your olive oil's flavor and antioxidants by transferring 7 to 10 days' worth of oil to a smaller bottle to lessen the oxidation that occurs when the oil is exposed to air. Leave this small bottle at room temperature for easy use, but refrigerate the rest. When chilled, olive oil will solidify slightly and turn cloudy, but once restored to room temperature, it will regain its normal appearance, and its quality will be better maintained. Although it may be convenient, definitely don't store your olive oil near the stove as the heat will damage it.

While we haven't seen research that discusses declines in carotenoids and vitamin E for extra virgin olive oil, we have seen it for virgin oil. While this is not the type of oil we recommend, we still thought to include this interesting information here:

Research conducted at the University of Lleida in Spain and reported in the *Journal of Agriculture and Food Chemistry* found that levels of chlorophyll, carotenoids and antioxidant phenols dropped dramatically after virgin olive oil had been in storage 12 months-even under the best controlled conditions.

Chlorophyll content dropped by as much as 30%; beta-carotene by 40%, and vitamin E (alpha-tocopherol) by 100%!

Phenols, which are not only the main antioxidants in virgin olive oil, but are also responsible for its distinctive rich flavor, also dropped precipitously after 12 months storage.

Research published in New Scientist magazine has confirmed that light destroys many of the antioxidants in olive oil. Researchers at the University of Bari, in southern Italy, compared oils stored in the light or in the dark for 12 months. Oils stored in clear bottles under supermarket lighting lost at least 30% of their tocopherols (vitamin E) and carotenoids.

After just two months' exposure to light, peroxide (free radical) levels had increased so much that the olive oil could no longer be classified as extra virgin.

How to Enjoy

A Few Quick Serving Ideas

- Use extra virgin olive oil in your salad dressings.
- Puree minced garlic, cooked potatoes and extra virgin olive oil together to make exceptionally delicious garlic mashed potatoes. Season to taste.
- Drizzle extra virgin olive oil over healthy sautéed vegetables before serving.
- Puree extra virgin olive oil, garlic and your favorite beans together in a food processor. Season to taste and serve as a dip.
- Instead of putting the butter dish out on the table, place a small cup of extra virgin olive oil out instead to use on your bread or rolls. For extra flavor, try adding a little Balsamic vinegar or any of your favorite spices to the extra virgin olive oil.

WHFoods Recipes That Feature Extra Virgin Olive Oil

You'll find that many of our recipes feature extra virgin olive oil. For example, we like to add it to vegetables after they have been lightly cooked, either on its own, or as part of our Mediterranean Dressing.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Olive Oil, cold pressed extra virgin
1.00 TBS
13.50 grams

Calories: 119
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin E	1.94 mg (ATE)	13	2.0	good

World's Healthiest Foods Rating	Rule
	DRI/DV>=75% OR

excellent	Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Olives

Even though more attention has been sometimes been given to their delicious oil than their whole food delights, olives are one of the world's most widely enjoyed foods. Technically classified as fruits of the *Olea europea* tree (an amazing tree that typically lives for hundreds of years) we commonly think about olives not as fruit but as a zesty vegetable that can be added are harvested in September but available year round to make a zesty addition to salads, meat and poultry dishes and, of course, pizza.

Olives are too bitter to be eaten right off the tree and must be cured to reduce their intrinsic bitterness. Processing methods vary with the olive variety, region where they are cultivated, and the desired taste, texture and color. Some olives are picked unripe, while others are allowed to fully ripen on the tree. The color of an olive is not necessarily related to its state of maturity. Many olives start off green and turn black when fully ripe. However, some olives start off green and remain green when fully ripe, while others start of black and remain black. In the United States, where most olives come from California, olives are typically green in color, picked in an unripe state, lye-cured, and then exposed to air as a way of triggering oxidation and conversion to a black outer color. Water curing, brine curing, and lye curing are the most common treatment processes for olives, and each of these treatments can affect the color and composition of the olives.

What's New and Beneficial About Olives

- Dozens of health-protective nutrients have been identified in olives, and recent studies have taken a very close look at olive varieties, olive processing, and changes that take place in olive nutrients. The overall conclusion from these studies is exciting for anyone who loves olives of all varieties. Greek-style black olives, Spanish-style green olives, Kalamata-style olives, and many different methods of olive preparation provide us with valuable amounts of many different antioxidant and anti-inflammatory nutrients. While there are trade-offs that occur during olive ripening and olive curing—for example, decreased oleuropein with advanced stages of ripening yet increased amounts of anthocyanins—it's impossible to rule out any single type of olive as being unworthy of consideration as a uniquely health-supportive food, particularly in terms of antioxidant and anti-inflammatory benefits.
- Hydroxytyrosol, an olive phytonutrient that has long been linked to cancer prevention, is now regarded as having the potential to help us prevent bone loss as well. Several recent laboratory animal studies have found increased depositing of calcium in bone and decreased loss of total bone mass following consumption of this olive phytonutrient (as well as oleuropein, another key phytonutrient found in olives). These findings are fascinating, since consumption of a Mediterranean Diet has long been associated with decreased risk of osteoporosis, and olives often find themselves on center stage in Mediterranean Diet studies.
- In traditional herbal medicine practices, preparations from olives and olive leaves have often been used in treatment of inflammatory problems, including allergy-related inflammation. New research may help explain how olives work to provide us with anti-inflammatory benefits, especially during circumstances involving allergy. Olive extracts have now been shown to function as anti-histamines at a cellular level. By blocking special histamine receptors (called H1 receptors), unique components in olive extracts may help to lessen a cell's histamine response. Because histamine is a molecule that can get overproduced in allergy-related conditions and can be a key player in the inflammatory process, it's likely that the anti-inflammatory benefits we get from olives involve this anti-histamine pathway. It's also possible that olives may have a special role to play as part of an overall anti-allergenic diet.

Olives, black, canned
1.00 cup
(134.40 grams)

Calories: 155
GI: very low

Nutrient	DRI/DV
copper	38%
iron	25%
fiber	17%
vitamin E	15%

Health Benefits

While commonly recognized as a high-fat food (about 80-85% of the calories in olives come from fat), olives are not always appreciated for the type of fat they contain. Olives are unusual in their fat quality, because they provide almost three-quarters of their fat as oleic acid, a monounsaturated fatty acid. (In addition they provide a small amount of the essential fatty acid called linoleic acid, and a very small amount of alpha-linolenic acid, an omega-3 fatty acid.) The high monounsaturated fat content of olives has been associated with reduced risk of cardiovascular disease. When diets low in monounsaturated fat are altered to increase the monounsaturated fat content (without becoming too high in total fat), research study participants typically experience a decrease in their blood cholesterol, LDL cholesterol, and LDL:HDL ratio. All of these changes lower our risk of heart disease.

Recent research studies have also shown that the monounsaturated fat found in olives (and olive oil) can help to decrease blood pressure. The oleic acid found in olives—once absorbed up into the body and transported to our cells—can change signaling patterns at a cell membrane level (specifically, altering G-protein associated cascades). These changes at a cell membrane level result in decreased blood pressure.

In terms of their phytonutrient content, olives are nothing short of astounding. Few high-fat foods offer such a diverse range of antioxidant and anti-inflammatory nutrients—some of which are unique to olives themselves. The list below shows some key phytonutrients in olives, organized by their chemical category:

- Simple Phenols
    - tyrosol
    - hydroxytyrosol
- Terpenes (including secoiridoids and triterpenes)
    - oleuropein
    - demethyloleuropein
    - erythrodiol
    - uvaol
    - oleanolic acid
    - elenoic acid
    - ligstroside
- Flavones
    - apigenin
    - luteolin
- Hydroxycinnamic acids
    - caffeic acid
    - cinnamic acid
    - ferulic acid
    - coumaric acid
- Anthocyanidins
    - cyanidins
    - peonidins
- Flavonols
    - quercetin
    - kaempferol
- Hydroxybenzoic acids
    - gallic acid
    - protocatechuic acid
    - vanillic acid
    - syringic acid
- Hydroxyphenylacetic acids
    - homovanillic acid
    - homveratric acid

Given this phytonutrient richness, it's not surprising that olives have documented health benefits that extend to most of our body systems. Olive benefits have been demonstrated for the cardiovascular system, respiratory system, nervous system, musculoskeletal system, immune system, inflammatory system, and digestive system. We believe that many of these diverse systems benefits are actually related to two underlying health-support aspects of olives, namely, their unusual antioxidant and anti-inflammatory nutrients. In this Health Benefits section, we will focus on those antioxidant and anti-inflammatory properties of olives, as well as some anti-cancer benefits that seem especially important with respect to this food.

Antioxidant Benefits

The vast majority of olive phytonutrients listed at the beginning of this section function as antioxidants and help us avoid unwanted problems due to oxidative stress. "Oxidative stress" is a situation in which our cells are insufficiently protected from potential oxygen damage, and oxidative stress can often be related to an insufficient supply of antioxidant nutrients. Olives are a good source of the antioxidant vitamin E, and they also contain small amounts of antioxidant minerals like selenium and zinc. However, it's the phytonutrient content of olives that makes them unique as an antioxidant-rich food.

Perhaps the best-studied antioxidant phytonutrient found in olives is oleuropein. Oleuropein is found exclusively in olives, and it's been shown to function as an antioxidant nutrient in a variety of ways. Intake of oleuropein has been shown to decrease oxidation of LDL cholesterol; to scavenge nitric oxide (a reactive oxygen-containing molecule); to lower several markers of oxidative stress; and to help protect nerve cells from oxygen-related damage.

One recent study that caught our attention has shown the ability of olives to increase blood levels of glutathione (one of the body's premier antioxidant nutrients). In a very interesting research twist, study participants were not given fresh olives to eat but rather the pulpy residue from olives that had been previously milled to produce olive oil. Consumption of this olive pulp was associated with significantly increased glutathione levels in the blood of the participants, and improvement in their antioxidant capacity.

Interestingly, there may be common trade-offs made in the levels of different olive antioxidants during the maturation of olives on the tree. For example, the vitamin E content of olives may increase during early ripening when the total phenolic antioxidants in olives are slightly decreasing. Later on in the maturation process, these trends may be reversed.

Anti-Inflammatory Benefits

In addition to their function as antioxidants, many of the phytonutrients found in olives have well-documented anti-inflammatory properties. Extracts from whole olives have been shown to function as anti-histamines at a cellular level. By blocking special histamine receptors (called H1 receptors), unique components in whole olive extracts help to provide us with anti-inflammatory benefits. In addition to their antihistamine properties, whole olive extracts have also been shown to lower risk of unwanted inflammation by lowering levels of leukotriene B4 (LTB4), a very common pro-inflammatory messaging molecule. Oleuropein—one of the unique phytonutrients found in olives—has been shown to decrease the activity of inducible nitric oxide synthase (iNOS). iNOS is an enzyme whose overactivity has been associated with unwanted inflammation. Taken as a group, these research findings point to olives as a uniquely anti-inflammatory food.

The anti-inflammatory benefits of olives have been given special attention in the area of cardiovascular health. In heart patients, olive polyphenols have been determined to lower blood levels of C-reactive protein (CRP). CRP is a widely used blood measurement for assessing the likelihood of unwanted inflammation. Olive polyphenols have also been found to reduce activity in a metabolic pathway called the arachidonic acid pathway, which is central for mobilizing inflammatory processes.

Anti-Cancer Benefits

The antioxidant and anti-inflammatory properties of olives make them a natural for protection against cancer because chronic oxidative stress and chronic inflammation can be key factors in the development of cancer. If our cells get overwhelmed by oxidative stress (damage to cell structure and cell function by overly reactive oxygen-containing molecules) and chronic excessive inflammation, our risk of cell cancer is increased. By providing us with rich supplies of antioxidant and anti-inflammatory nutrients, olives can help us avoid this dangerous combination of chronic oxidative stress and chronic inflammation.

Research on whole olives and cancer has often focused on two cancer types: breast cancer and stomach (gastric) cancer. In the case of breast cancer, special attention has been paid to the triterpene phytonutrients in olives, including erythrodiol, uvaol and oleanolic acid. These olive phytonutrients have been shown to help interrupt the life cycle of breast cancer cells. Interruption of cell cycles has also been shown in the case of gastric cancer, but with this second type of cancer, the exact olive phytonutrients involved are less clear.

One of the mechanisms linking olive intake to cancer protection may involve our genes. Antioxidant phytonutrients in olives may have a special ability to protect DNA (deoxyribonucleic acids)—the key chemical component of genetic material in our cells—from oxygen damage. DNA protection from unwanted oxidative stress means better cell function in wide variety of ways and provides cells with decreased risk of cancer development.

Description

From a botanical standpoint, olives belong to a very special group of fruits called drupes. Drupes are fruits that have a pit or stone at their core, and this pit is surrounded by a larger fleshy portion called the pericarp. Other drupes commonly found in diets worldwide include mango, cherry, peach, plum, apricot, nectarine, almond, and pistachio.

There are literally hundreds of varieties of olive trees, but all of them belong in the same scientific category of *Olea europea*. "Olea" is the Latin word for "oil," and reflects the high oil content of this food. Olive trees are native to the Mediterranean, as well as different parts of Asia and Africa. Their Mediterranean origins are highlighted in their species name, *europea*, since countries bordering the north shore of the Mediterranean Sea are typically considered as parts of southern Europe. Olive trees can have remarkable longevity. Most live to an age of several hundred years, and in at least one case, a carbon-dated world record for an olive tree stands at 2,000 years! Although olive trees may produce more olives in lowland terrain, they are comfortable growing in mountainous, rocky conditions and often thrive along the hillsides of Spain, Italy and Greece.

Olives come in many different varieties. In the United States, five varieties account for most commercial production. These varieties are Manzanillo, Sevillano, Mission, Ascolano and Barouni, and all are grown almost exclusively in California. Picholine and Rubra are two additional varieties produced in California in smaller amounts.

Kalamata olives are one olive variety that deserves special mention. Authentic Kalamata olives come from Kalamon olive trees in southern Greece and get their name from Kalamata, their city of origin. European Union (EU) law provides Kalamata olives with Protected Geographical Status and Protected Designation of Origin and does not allow product labeling as "Kalamata" unless the olives have come from this specific area. However, outside of the European Union countries, there are no binding legal standards for labeling of Kalamata olives. In the U.S., many canned and jarred olives are referred to as "Kalamata-style" or "Kalamata-type" olives and these olives are not authentic Kalamata olives grown in the Kalamata area of southern Greece. Genuine Kalamata olives are usually allowed to ripe fully before harvest. Different methods of curing can be used during production of Kalamata olives. Some Greek producers use dry-curing as a method of choice. In dry-curing, olives are covered directly in salt rather than soaked in brine (a concentrated salt liquid). Dry-curing is often used for olives that will be stored for longer periods of time, and Kalamata olives that have been dry-cured can often be identified by their wrinkly skin. Dry-cured Kalamata olives are eventually packaged in olive oil or olive oil/vinegar combinations to which other seasonings are sometimes added. Kalamata olives can also be cured in a salt brine or in water, and in both cases, red wine vinegar and/or red wine are typically used to give the olives their delicious flavors. Most "Kalamata-style" and "Kalamata-type" olives have been cured in this way. Authentic Kalamata olives from southern Greece that have been cured using red wine and/or red wine vinegar are available in many groceries, especially those groceries that stock specialty foods. Genuine Kalamata olives will almost always be labeled as "imported" and may also be labeled as "PDO Kalamata" to reflect their compliance with European Union regulations.

Kalamata are only one among many Mediterranean olive varieties. The list below contains some of the better-known varieties of Mediterranean olives:

- ITALY
    - Cipresino
    - Coratina
    - Frantoio
    - Grappoio
    - Intrana
    - Leccino
    - Lecin de Sevilla
    - Moraiolo
    - Pendolino
    - Santa Cateria
    - Taggiasca
- SPAIN
    - Arbequina
    - Bical
    - Blanqueta
    - Cornicabra
    - Farga
    - Gordal Sevillana
    - Hojiblanca
    - Lemono
    - Manzanillo
    - Morrut
    - Nevadillo
    - Piqual
- GREECE
    - Adriamitini
    - Amigdalolia

  - Chalkidiki
  - Kalamon
  - Koroneiki
  - Megaritiki
  - Mirtoia

When freshly picked from the tree, olives often (but not always) have a bitter flavor. This bitterness is related to their phytonutrient content, and especially to their concentration of oleuropein (a secoirodoid terpene). In order to help offset their bitter taste, olives are typically cured. (Curing is also sometimes referred to as "pickling.") There are three basic types of curing widely used to lower the bitterness in olives. There types are:

Water-curing

Water-curing of olives—just like the name suggests—involves submersion of the olives in water for a period of several weeks or longer. Water-cured olives typically remain slightly bitter because water-curing removes less oleuropein from the olives than other curing methods.

Brine-curing

Brine-curing involves the submersion of olives in a concentrated salt solution. Greek style olives in brine and Sicilian style olives in brine are examples of brine-cured olives. Brine-curing can take many months, and olives often undergo fermentation during the brine-curing process. (Fermentation means that the sugars found in olives will often get broken down into lactic or acetic acid, and oleuropein will be freed to migrate into the brine.) Many changes in flavor and phytonutrient composition can take place during the brine-curing process.

Lye-curing

Lye-curing involves the submersion of olives in a strong alkali solutions containing either sodium hydroxide ($NaOH$) or potassium hydroxide (KOH). Lye-curing usually occurs in a series of sequential steps. A first lye bath will cure the skin and outermost portion of the olives. This first solution is then drained from the olives and discarded and the olives are submerged in a second lye solution which begins to cure the next layer of fleshy pulp inside the olive. Up to five lye solutions may be required to cure the entire olive, all the way down to the pit. Dark style ripe olives and green olives are examples of olives that have typically been lye-cured.

During the last stage of lye-curing, oxygen gas is often bubbled up through the lye solution to help darken the olives. In the United States, canned California black olives are typically lye-cured and oxygen-darkened.

Curing is not the only factor that can influence the color of an olive, and it's worth pointing out that olive color does not automatically indicate anything about the curing process. Many olives start off green and turn black on the tree when fully ripe. Other olives start off green on the tree, remain green when fully ripe, and can only be darkened by curing and/or air exposure. Still other olives start of black on the tree and remain black at full maturity.

History

Olives have been cultivated in parts of the Mediterranean—including Crete and Syria—for at least 5,000 years. In addition, there is carbon-dating evidence of olive tree presence in Spain as many as 6,000–8,000 years ago. This ancient and legendary tree was also native to parts of Asia and Africa.

It's not clear exactly how olive trees arrived in the U.S., but it's clear that the time frame was much later, during the 1500-1700's. Spanish colonizers of North America definitely brought olive trees across the Atlantic Ocean during the 1500-1700's, and while some may have been brought directly to the region which is now California, olive trees may also have been brought to the region from Mexico, where cultivation by the Spanish was already underway.

Olives constitute one of the world's largest fruit crops, with more than 25 million acres of olive trees planted worldwide. (On a worldwide basis, olives are produced in greater amounts than either grapes, apples, or oranges.) Spain is the largest single producer of olives at approximately 6 million tons per year. Italy is second at approximately 3.5 million tons, followed by Greece at 2.5 million. Turkey and Syria are the next major olive producers. Mediterranean production of olives currently involves approximately 800 million trees. 90% of all Mediterranean olives are crushed for the production of olive oil, with the remaining 10% kept in whole food form for eating. In the United States, California's Central Valley is the site of most olive production, on approximately 27,000 acres.

How to Select and Store

While olives have been traditionally sold in jars and cans, many stores are now offering them in bulk in large barrels or bins (often called an "olive bar"). Buying bulk olives will allow you to experiment with many different types with which you may be unfamiliar and to purchase only as many as you need at one time.

While whole olives are very common, you may also find ones that have been pitted, as well as olives that have been stuffed with either peppers, garlic or almonds. If you purchase olives in bulk, make sure that the store has a good turnover and keeps their olives immersed in brine for freshness and to retain moistness.

When selecting olives from an olive bar, you'll often be faced with a wide variety of color options and textures. It's not uncommon to find color varieties of olives that include green, yellow-green, green-gray, rose, red-brown, dark red, purplish-black and black. It's also not uncommon to find several different textures, including shiny, wilted, or cracked. The size of olives may range from fairly small to fairly large or jumbo. Each of these options among olive varieties can provide you with valuable health benefits. In general, regardless of the variety you choose, select olives that still display a reasonable about of firmness and are not overly soft or mushy.

If you are purchasing olives in a can and don't use them immediately after opening, they can usually be safely stored in sealed container in your refrigerator for one to two weeks. Whether brine-based, acid-based, or water-based, you can transfer the canning fluid along with the olives into your sealed refrigerator container. Glass jars of olives can be stored directly in the refrigerator for the same period of time, and in the case of some brine-cured olives, for up to one to two months.

When selecting olives, beware of the label description, "hand-picked." This description does not necessarily tell you anything helpful about the olive harvesting. Many olives are hand-picked, even though the product label makes no mention of this fact. Conversely, olives with have been mechanically harvested with a hand-held pneumatic rake are sometimes labeled as "hand-picked."

How to Enjoy

A Few Quick Serving Ideas

- Olive tapenade is a delicious and easy-to-make spread that you can use as a dip, sandwich spread, or topping for fish and poultry. To make it, put pitted olives in a food processor with olive oil, garlic, and your favorite seasonings.
- Toss pasta with chopped olives, tomatoes, garlic, olive oil and fresh herbs of your choice.
- Marinate olives in olive oil, lemon zest, coriander seeds and cumin seeds.
- Add chopped olives to your favorite tuna or chicken salad recipe.
- Set out a small plate of olives on the dinner table along with some vegetable crudités for your family to enjoy with the meal.

WHFoods Recipes That Include Olives

- 15-Minute Turkey Chef's Salad
- Greek Salad
- Kidney Bean Salad with Mediterranean Dressing
- Mediterranean Baby Spinach Salad
- Salad Nicoise
- Braised Cod with Celery
- 5-Minute Cold Cucumber Salad
- Olive Tapenade
- Vegetable Appetizer 3

Safety

Olives and Acrylamides

Research on olives and their acrylamide content has shown some inconsistency over the past several years and this inconsistency has sparked controversy in the public press about olives and their health risk with respect to acrylamide. In data assembled by the U.S. Food and Drug Administration (FDA), we've seen more than a dozen different kinds of olives, including Spanish, Greek, Kalamata, Nolellata, Sicilian, d'Abruzzo, and Gaeta, and di Cerignola that were determined to contain no detectable level of acrylamide. Yet we have also seen FDA data showing levels of acrylamide as high as 1,925 ppb in some canned, nationally distributed brands of black pitted olives. Based on this data, we suspect that these higher acrylamide levels in select canned black olives were related to specific handling, storage, processing (especially preservation and darkening methods), and heating steps that favored formation of acrylamide. (One 2008 study from a research team in Seville, Spain has also determined that darkening methods can influence acrylamide formation, but only within the context of many other factors, including the variety of olive itself.) It's also important to note here that we are not aware of any data showing problematic levels of acrylamide in any extra virgin olive oils available in the marketplace.

At present, we are not aware of any foolproof method that consumers can use to avoid purchase of canned black olives that contain unwanted amounts of acrylamide. Since the FDA data has shown no detectable levels of acrylamide in numerous samples of imported olives packed in brine, those olives may be worth considering as options that may help avoid unwanted acrylamide. As stated previously, extra virgin olive oil is another form of this nutrient-rich food that, to our knowledge, has not been shown in research to contain unwanted amounts of acrylamide.

For more on acrylamides, see our detailed write-up on the subject.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Olives, black, canned
1.00 cup
134.40 grams

Calories: 155
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
copper	0.34 mg	38	4.4	very good
iron	4.44 mg	25	2.9	good
fiber	4.30 g	17	2.0	good
vitamin E	2.22 mg (ATE)	15	1.7	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Onions

What's New and Beneficial About Onions

- The flavonoids in onion tend to be more concentrated in the outer layers of the flesh. To maximize your health benefits, peel off as little of the fleshy, edible portion as possible when removing the onion's outermost paper layer. Even a small amount of "overpeeling" can result in unwanted loss of flavonoids. For example, a red onion can lose about 20% of its quercetin and almost 75% of its anthocyanins if it is "overpeeled."
- The total polyphenol content of onions is much higher than many people expect. (Polyphenols are one of the largest categories of phytonutrients in food. This category includes all flavonoids as well as tannins.) The total polyphenol content of onion is not only higher than its fellow allium vegetables, garlic and leeks, but also higher than tomatoes, carrots, and red bell pepper. In the French diet, only six vegetables (artichoke heart, parsley, Brussels sprouts, shallot, broccoli, and celery) have a higher polyphenol content than onion. Since the French diet has been of special interest to researchers in terms of disease prevention, onion's strong polyphenol contribution will very likely lead to follow-up studies that pay closer attention to this unique allium vegetable.
- Within the polyphenol category, onions are also surprisingly high in flavonoids. For example, on an ounce-for-ounce basis, onions rank in the top 10 of commonly eaten vegetables in their quercetin content. The flavonoid content of onions can vary widely, depending on the exact variety and growing conditions. Although the average onion is likely to contain less than 100 milligrams of quercetin per 3-1/2 ounces, some onions do provide this amount. And while 100 milligrams may not sound like a lot, in the United States, moderate vegetable eaters average only twice this amount for *all* flavonoids (not just quercetin) from *all* vegetables per day.
- When onions are simmered to make soup, their quercetin does not get degraded. It simply gets transferred into the water part of the soup. By using a low-heat method for preparing onion soup, you can preserve the health benefits of onion that are associated with this key flavonoid.
- When we get quercetin by eating an onion-rather than consuming the quercetin in purified, supplement form-we may end up getting better protection from oxidative stress. That's exactly what happened in an animal study where some animals had yellow onion added to their diet in a way that would provide the same amount of quercetin provided to other animals in the form of purified quercetin extracts. The best protection came from the onion version of this flavonoid, rather than the supplement form.
- Several servings of onion each week are sufficient to statistically lower your risk of some types of cancer. For colorectal, laryngeal, and ovarian cancer, between 1-7 servings of onion has been shown to provide risk reduction. But for decreased risk of oral and esophageal cancer, you'll need to consume one onion serving per day (approximately 1/2 cup).

WHFoods Recommendations

With their unique combination of flavonoids and sulfur-containing nutrients, the allium vegetables—such as onions—belong in your diet on a regular basis. There's research evidence for including at least one serving of an allium vegetable—such as onions—in your meal plan every day.

When onion is your allium vegetable of choice, try to consume at least one-half of a medium onion on that day, and use this guideline to adjust your recipes accordingly. For example, if you are following a recipe that yields 4 servings, include at least 2 medium onions in the recipe so that each of your 4 servings will contain at least one half medium onion.

To bring out the sweet flavor of onions we recommend using our Healthy Saute method of cooking onions for just 7 minutes. Cut onions into slices of equal 1/4-inch thickness to help them cook more evenly. The thinner you slice the onions the more quickly they will cook. Let them sit for at least 5 minutes to enhance their health-promoting properties. For more details see the Healthiest Way of Cooking Onions in the How to Enjoy section below.

Onions, chopped, cooked
1.00 cup
(210.00 grams)

Calories: 92
GI: low

Nutrient	DRI/DV
biotin	27%
manganese	16%
copper	16%
vitamin B6	16%
vitamin C	15%

fiber	12%
phosphorus	11%
potassium	10%
vitamin B1	8%
folate	8%

Health Benefits

Onions, like garlic, are members of the Allium family, and both are rich in sulfur-containing compounds that are responsible for their pungent odors and for many of their health-promoting effects. A wide variety of allyl sulfides are found in onion, including the four major diallyl sulfides: DMS (diallyl monosulfide), DDS (diallyl disulfide), DTS (diallyl trisulfide), and DTTS (diallyl tetrasulfide). Also present are a wide variety of sulfoxides, including (+) S-methyl-L-cysteine sulfoxide (MCSO), (+)-S-(1-propenyl)-L-cysteine sulfoxide (PRENCSO), S-methyl-l-cysteine sulfoxide, S-propyl-l-cysteine sulfoxide, and S-propenyl-l-cysteine sulfoxide. Onions are an outstanding source of polyphenols, including the flavonoid polyphenols. Within this flavonoid category, onions are a standout source of quercetin.

Cardiovascular Benefits

Unlike the research on garlic and its cardiovascular benefits, research specifically focused on onion has mostly been conducted on animals rather than humans. In animal studies, there is evidence that onion's sulfur compounds may work in an anti-clotting capacity and help prevent the unwanted clumping together of blood platelet cells. There is also evidence showing that sulfur compounds in onion can lower blood levels of cholesterol and triglycerides, and also improve cell membrane function in red blood cells.

In human studies, most of the cardiovascular benefits have been demonstrated in the form of overall diet. Multiple studies show onion to be a food that provides protection for the heart and blood vessels when consumed in a diet that is rich in other vegetables and fruits—especially flavonoid-containing vegetables and fruits. The benefits of onion in this overall dietary context extend to prevention of heart attack. In virtually all of these diet-based studies, participants with the greatest intake of vegetables (including onions) gain the most protection. The outstanding flavonoid content of onions supports these research findings. It's also interesting to note that onion is most commonly consumed in relatively small amounts along with other foods rather than by itself. For this reason, it can be more difficult to study in large-scale dietary research studies that involve thousands of participants and rely on diet diaries to determine onion consumption.

Support for Bone and Connective Tissue

Human studies have shown that onion can help increase our bone density and may be of special benefit to women of menopausal age who are experiencing loss of bone density. In addition, there is evidence that women who have passed the age of menopause may be able to lower their risk of hip fracture through frequent consumption of onions. "Frequent" in this context means onion consumption on a daily basis! In this research on bone density in older women, very sporadic eating of onion (once a month or less) did not provide much benefit. That finding, of course, was very expected. But less expected was the finding that it took daily consumption of onion to show robust benefits for bone density. Just as in the cancer-related onion research, the take-away message here is clear: you don't want to skimp on onions when you are incorporating them into your meal plan.

In and of itself, the high sulfur content of onions may provide direct benefits to our connective tissue. Many of our connective tissue components require sulfur for their formation. For example, with the exception of hyaluronic acid, all glycosaminoglycans (GAGS) are sulfated. (GAGS are the premiere family of molecules found in the ground substance of our connective tissue.)

Anti-Inflammatory Benefits

While onion is not as well researched as garlic in terms of specific inflammatory health problems like rheumatoid arthritis or allergic airway inflammation, this allium vegetable has nevertheless been shown to provide important anti-inflammatory benefits. Onionin A—a unique sulfur molecule in onion that is found in the bulb portion of the plant—has been shown to inhibit the activity of macrophages, specialized white blood cells that play a key role in our body's immune defense system, and one of their defense activities involves the triggering of large-scale inflammatory responses. While macrophage activity is typically a good thing, inhibition of their activity can sometimes be critical in getting chronic unwanted inflammation under control.

Onion's antioxidants—including its hallmark flavonoid antioxidant, quercetin—also provide us with anti-inflammatory benefits. These antioxidants help prevent the oxidation of fatty acids in our body. When we have lower levels of oxidized fatty acids, our body produces fewer pro-inflammatory messaging molecules, and our level of inflammation is kept in check.

Cancer Protection

Onion has repeatedly been shown to lower our risk of several cancers, even when we consume it in only moderate amounts. "Moderate" generally means 1-2 times per week, even though in some studies it has been used to mean up to 5-6 times per week. Colorectal cancer, laryngeal cancer, and ovarian cancer are the cancer types for which risk is reduced along with moderate amounts of dietary onion. For other cancer types, however, moderate intake of onion has not been enough to show significant risk reduction. For these cancer types—including esophageal cancer and cancers of the mouth—daily intake of onion is required before research results show significant risk reduction.

Many factors may play a role in these different research findings for different cancer types. However, the overall take-away from this research seems clear: you do not want to err on the side of small onion servings or infrequent onion intake if you want to obtain the full cancer-related benefits of onion. A few slivers of sliced onion on a tossed salad are a good thing—but probably not enough to provide you with the cancer-related onion benefits that you are seeking. In recipes that already call for onion, try to include at least 1 whole onion (medium size) in the recipe. In recipes that do not already call for onion, consider the addition of 1 medium size onion (if you think onion might fit into the recipe and still provide a tasty outcome). In terms of individual portion sizes when you sit down to eat a meal, try to consume the equivalent of 1/2 onion.

Other Health Benefits

In animal studies, onions have shown potential for improvement of blood sugar balance, even though it is not yet clear about the carry over of these benefits for humans who are seeking better blood sugar balance from their diet. Most of the animal studies have been conducted on rats, and most have used onion juice or onion extract as the form of onion tested. Future research is needed to clarify onion's potential for helping lower blood sugar and improving blood sugar control, especially in persons with blood sugar problems.

While not as well researched as garlic in terms of antibacterial benefits, onion has nevertheless been shown to help prevent bacterial infection. Along with its sulfur-containing compounds, the flavonoid quercetin contained in onion helps provide these antibacterial benefits. We've seen studies showing antibacterial activity of onion in relationship to the bacteria Streptococcus mutans and Streptococcus sobrinus. (These bacteria are commonly involved in the production of tooth cavities). Antibacterial benefits have also been shown in the area of gum (periodontal) disease bacteria, including *Porphyromonas gingivalis* and *Prevotella intermedia*. Interestingly, in one study, fresh, chopped, uncooked onion had antibacterial effects on these potentially unwanted gum bacteria, but non-fresh, uncooked onion (raw onion that was chopped and then left to sit for 2 days at room temperature) did not demonstrate these same antibacterial properties nor did fresh onion that was grated and then steamed for 10 minutes. While it is not possible to draw broad conclusions from a single lab study, these findings suggest that length of storage (for onion that has been chopped but not cooked) and duration of heat exposure (in this case involving exposure to steam for 10 full minutes) can affect some of onion's health benefits. For these reasons, special care may be needed in the storage, handling, and cooking of this allium vegetable.

Description

What would a kitchen be without the distinctively pungent smell and taste of onions filling out the flavors of almost every type of cuisine imaginable? Fortunately, yellow storage onions are available throughout the year although sweet varieties have a much more limited growing season and are available only a few months out of the year.

While onions may bring a tear to your eye and a pungency to your breath they will also certainly bring delight to your taste buds. The onion, known scientifically as *Allium cepa*, is, on the surface, a humble brown, white or red, paper-thin skinned bulb; yet, despite its plain looks, it has an intense flavor and is a beloved part of the cuisine of almost every region of the world.

The word onion comes from the Latin word *unio*, which means "single," or "one"—reflecting of the onion plant producing a single bulb, unlike its cousin, the garlic, that produces many small bulbs. The name also describes the onion bulb when cut down the middle; it is a union (also from *unio*) of many separate, concentrically arranged layers.

Onions range in size, color, and taste depending upon their variety. There are generally two types of large, globe-shaped onions, classified as spring/summer or storage onions. The former class includes those that are grown in warm weather climates and have characteristic mild or sweet tastes. Included in this group are the Maui Sweet Onion (in season April through

June), Vidalia (in season May through June) and Walla Walla (in season July and August). Storage onions are grown in colder weather climates and, after harvesting, are dried out for a period of several months, which allows them to attain dry, crisp skins. They generally have a more pungent flavor and are usually named by their color: white, yellow or red. Spanish onions fall into this classification. In addition to these large onions, there are also smaller varieties such as the green onion, or scallion, and the pearl onion.

Onions are a major source of polyphenols in general, and also of flavonoids (a very important subdivision of polyphenols). They can also vary greatly in their polyphenol and flavonoid content. In general, red onions are higher in total flavonoids than white onions, (with yellow onions falling somewhere in between).

History

Onions are native to Asia and the Middle East and have been cultivated for over five thousand years. Onions were highly regarded by the Egyptians. Not only did they use them as currency to pay the workers who built the pyramids, but they also placed them in the tombs of kings, such as Tutankhamen, so that they could carry these gifts bestowed with spiritual significance with them to the afterlife.

Onions have been revered throughout time not only for their culinary use, but also for their therapeutic properties. As early as the 6th century, onions were used as a medicine in India. While they were popular with the ancient Greeks and Romans, they were oftentimes dressed with extra seasonings since many people did not find them spicy enough. Yet, it was their pungency that made onions popular among poor people throughout the world who could freely use this inexpensive vegetable to spark up their meals. Onions were an indispensable vegetable in the cuisines of many European countries during the Middle Ages and later even served as a classic healthy breakfast food. Christopher Columbus brought onions to the West Indies; their cultivation spread from there throughout the Western Hemisphere. Today China, India, the United States, Russian, and Spain are among the leading producers of onions.

How to Select and Store

Choose onions that are clean, well shaped, have no opening at the neck, and feature crisp, dry outer skins. Avoid those that are sprouting or have signs of mold. In addition, onions of inferior quality often have soft spots, moisture at their neck, and dark patches, which may all be indications of decay. As conventionally grown onions are often irradiated to prevent them from sprouting, purchase organically grown varieties whenever possible to avoid onions that have undergone this process. When purchasing scallions, look for those that have green, fresh-looking tops that appear crisp yet tender. The base should be whitish in color for two or three inches. Avoid those that have wilted or yellowed tops.

Onions should be stored in a well ventilated space at room temperature, away from heat and bright light. With the exception of green onions, do not refrigerate onions. Place them in a wire hanging basket or a perforated bowl with a raised base so that air can circulate underneath. The length of storage varies with the type of onion. Those that are more pungent in flavor, such as yellow onions, should keep for about a month if stored properly. They will keep longer than those with a sweeter taste, such as white onions, since the compounds that confer their sharp taste help to preserve them. Scallions should be stored in a plastic bag in the refrigerator where they will keep for about one week. All onions should be stored away from potatoes, as they will absorb their moisture and ethylene gas, causing them to spoil more readily.

Store cut onions by placing in a sealed container; use them within a day or two since they tend to oxidize and lose their nutrient content rather quickly. Cooked onions will best maintain their taste in an airtight container where they can be kept for a few days; they should never be placed in a metal storage container as this may cause them to discolor. Although peeled and chopped onions can be frozen (without first being blanched), this process will cause them to lose some of their flavor.

How to Enjoy

A Few Quick Serving Ideas

- Combine chopped onions, tomatoes, avocado, and jalapeno for an all-in-one guacamole salsa dip.
- To perk up plain rice, top with green onions (scallions) and sesame seeds.
- Healthy Sauteed chopped onions can enhance the flavor or almost any vegetable dish.
- Enjoy a classic Italian salad—sliced onions, tomatoes, and mozzarella cheese drizzled with olive oil.

WHFoods Recipes that Feature Onions

- 5 Spice Onion Soup
- 7-Minute Healthy Sautéed Onions

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Onions, chopped, cooked
1.00 cup
210.00 grams

Calories: 92
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
biotin	7.98 mcg	27	5.2	very good
manganese	0.32 mg	16	3.1	good
vitamin B6	0.27 mg	16	3.1	good
copper	0.14 mg	16	3.0	good
vitamin C	10.92 mg	15	2.8	good
fiber	2.94 g	12	2.3	good
phosphorus	73.50 mg	11	2.0	good
potassium	348.60 mg	10	1.9	good
folate	31.50 mcg	8	1.5	good
vitamin B1	0.09 mg	8	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Potatoes

About Potatoes

Whether mashed, baked or roasted, people often consider potatoes as comfort food. It is an important food staple and the number one vegetable crop in the world. Potatoes are available year-round as they are harvested somewhere every month of the year.

The potato belongs to the Solanaceae or nightshade family whose other members include tomatoes, eggplants, peppers, and tomatillos. They are the swollen portion of the underground stem which is called a tuber and is designed to provide food for the green leafy portion of the plant. If allowed to flower and fruit, the potato plant will bear an inedible fruit resembling a tomato.

Potatoes, baked
1.00 cup
(173.00 grams)

Calories: 161
GI: high

Nutrient	DRI/DV
vitamin B6	32%
potassium	26%
copper	22%
vitamin C	22%
manganese	19%
phosphorus	17%
fiber	15%
vitamin B3	15%
pantothenic acid	13%

Health Benefits

Potatoes are a very popular food source. Unfortunately, most people eat potatoes in the form of greasy French fries or potato chips, and even baked potatoes are typically loaded down with fats such as butter, sour cream, melted cheese and bacon bits. Such treatment can make even baked potatoes a potential contributor to a heart attack. But take away the extra fat and deep frying, and a baked potato is an exceptionally healthful low calorie, high fiber food that offers significant protection against cardiovascular disease and cancer.

Our food ranking system qualified potatoes as a very good source of vitamin B6 and a good source of potassium, copper, vitamin C, manganese, phosphorus, niacin, dietary fiber, and pantothenic acid.

Potatoes also contain a variety of phytonutrients that have antioxidant activity. Among these important health-promoting compounds are carotenoids, flavonoids, and caffeic acid, as well as unique tuber storage proteins, such as patatin, which exhibit activity against free radicals.

Blood-Pressure Lowering Potential

UK scientists at the Institute for Food Research have identified blood pressure-lowering compounds called kukoamines in potatoes. Previously only found in *Lycium chinense*, an exotic herbal plant whose bark is used to make an infusion in Chinese herbal medicine, kukoamines were found in potatoes using a new type of research called metabolomics.

Until now, when analyzing a plant's composition, scientists had to know what they were seeking and could typically look for 30 or so known compounds. Now, metabolomic techniques enable researchers to find the unexpected by analyzing the 100s or even 1000s of small molecules produced by an organism.

"Potatoes have been cultivated for thousands of years, and we thought traditional crops were pretty well understood," said IFR food scientist Dr Fred Mellon, "but this surprise finding shows that even the most familiar of foods might conceal a hoard of health-promoting chemicals." Another good reason to center your diet around the World's Healthiest Foods!

In addition to potatoes, researchers looked at tomatoes since they belong to the same plant family—*Solanaceae*—as *Lycium chinense*. Metabolomic assays also detected kukoamine compounds in tomatoes.

The IFR scientists found higher levels of kukoamines and related compounds than some of the other compounds in potatoes that have a long history of scientific investigation. However, because they were previously only noted in *Lycium chinense*, kukoamines have been little studied. Researchers are now determining their stability during cooking and dose response (how much of these compounds are needed to impact health).

Vitamin B6—Building Your Cells

If only for its high concentration of vitamin B6—1 medium potato contains over one-half of a milligram of this important nutrient—the potato earns high marks as a health-promoting food.

Vitamin B6 is involved in more than 100 enzymatic reactions. Enzymes are proteins that help chemical reactions take place, so vitamin B6 is active virtually everywhere in the body. Many of the building blocks of protein, *amino acids*, require B6 for their synthesis, as do the *nucleic acids* used in the creation of our DNA. Because amino and nucleic acids are such critical parts of new cell formation, vitamin B6 is essential for the formation of virtually all new cells in the body. *Heme* (the protein center of our red blood cells) and *phospholipids* (cell membrane components that enable messaging between cells) also depend on vitamin B6 for their creation.

Vitamin B6—Brain Cell and Nervous System Activity

Vitamin B6 plays numerous roles in our nervous system, many of which involve neurological (brain cell) activity. B6 is necessary for the creation of *amines*, a type of messaging molecule or neurotransmitter that the nervous system relies on to transmit messages from one nerve to the next. Some of the amine-derived neurotransmitters that require vitamin B6 for their production are *serotonin*, a lack of which is linked to depression; *melatonin*, the hormone needed for a good night's sleep; *epinephrine* and *norepinephrine*, hormones that help us respond to stress; and *GABA*, which is needed for normal brain function.

Vitamin B6—Cardiovascular Protection

Vitamin B6 plays another critically important role in *methylation*, a chemical process in which methyl groups are transferred from one molecule to another. Many essential chemical events in the body are made possible by methylation, for example, genes can be switched on and turned off in this way. This is particularly important in cancer prevention since one of the genes that can be switched on and off is the tumor suppressor gene, p53. Another way that methylation helps prevent cancer is by attaching methyl groups to toxic substances to make them less toxic and encourage their elimination from the body.

Methylation is also important to cardiovascular health. Methylation changes a potentially dangerous molecule called *homocysteine* into other, benign substances. Since homocysteine can directly damage blood vessel walls greatly increasing the progression of atherosclerosis, high homocysteine levels are associated with a significantly increased risk for heart attack and stroke. Eating foods rich in vitamin B6 can help keep homocysteine levels low. In addition, diets high in vitamin B6-rich foods are associated with overall lower rates of heart disease, even when homocysteine levels are normal, most likely because of all the other beneficial activities of this energetic B vitamin.

A single baked potato will also provide you with over 3 grams of fiber, but remember the fiber in potatoes is mostly in their skin. If you want the cholesterol-lowering, colon cancer preventing, and bowel supportive effects of fiber, be sure to eat the potato's flavorful skin as well as its creamy center.

Vitamin B6—Athletic Performance

Vitamin B6 is also necessary for the breakdown of glycogen, the form in which sugar is stored in our muscle cells and liver, so this vitamin is a key player in athletic performance and endurance.

Description

Whether it is mashed, baked or made into French fries, many people often think of the potato as a comfort food. This sentiment probably inspired the potato's scientific name, *Solanum tuberosum*, since *solanum* is derived from a Latin word meaning "soothing". The potato's name also reflects that it belongs to the *Solanaceae* family whose other members include tomatoes, eggplants, peppers, and tomatillos.

There are about about 100 varieties of edible potatoes. They range in size, shape, color, starch content and flavor. They are often classified as either mature potatoes (the large potatoes that we are generally familiar with) and new potatoes (those that are harvested before maturity and are of a much smaller size). Some of the popular varieties of mature potatoes include the Russet Burbank, the White Rose and the Katahdin, while the Red LeSoda and Red Pontiac are two types of new potatoes. There are also delicate fingerling varieties available which, as their name suggests, are finger-shaped.

The skin of potatoes is generally brown, red or yellow, and may be smooth or rough, while the flesh is yellow or white. There are also other varieties available that feature purple-grey skin and a beautiful deep violet flesh.

As potatoes have a neutral starchy flavor, they serve as a good complement to many meals. Their texture varies slightly depending upon their preparation, but it can be generally described as rich and creamy.

History

Potatoes originated in the Andean mountain region of South America. Researchers estimate that potatoes have been cultivated by the Indians living in these areas for between 4,000 and 7,000 years. Unlike many other foods, potatoes were able to be grown at the high altitudes typical of this area and therefore became a staple food for these hardy people.

Potatoes were brought to Europe by Spanish explorers who "discovered" them in South America in the early 16th century. Since potatoes are good sources of vitamin C, they were subsequently used on Spanish ships to prevent scurvy. They were introduced into Europe via Spain, and while they were consumed by some people in Italy and Germany, they were not widely consumed throughout Europe, even though many governments actively promoted this nutritious foodstuff that was relatively inexpensive to produce. The reason for this is that since people knew that the potato is related to the nightshade family, many felt that it was poisonous like some other members of this family. In addition, many judged potatoes with suspicion since they were not mentioned in the Bible. In fact, potatoes initially had such a poor reputation in Europe that many people thought eating them would cause leprosy.

Some of the credit for the rise in potatoes' popularity is given to two individuals who creatively engineered plans to create demand for the potato. In the 18th century, a French agronomist named Parmentier created a scheme whereby peasants could "steal" potatoes from the King's "guarded" gardens. He also developed and popularized the mashed potato that became popular probably because he made this suspicious vegetable unrecognizable. Another person who was instrumental to the acceptance of potatoes was Count Rumford. A member of the British scientific group, the Royal Society, Rumford created a mush soup made of potatoes, barley, peas and vinegar, which the German peasants adopted as a satisfying and inexpensive dish.

It is thought that the potato was first brought to the United States in the early 18th century by Irish immigrants who settled in New England. People in this country were slow to adopt the "Irish potato" and large scale cultivation of potatoes did not occur in the U.S. until the 19th century.

There are not that many foods that can claim that a pivotal historical event centered around them. But the potato can. By the early 19th century, potatoes were being grown extensively throughout Northern Europe, and potatoes were almost solely relied upon as a foodstuff in Ireland owing to this vegetable's inexpensive production and the poor economy of this country. Yet, in 1845 and 1846, a blight ruined most of the potato crop in Ireland and caused major devastation: this event is known as the Irish Potato Famine. Almost three-quarters of a million people died, and hundreds of thousands emigrated to other countries, including the United States, in search of sustenance.

Today, this once-infamous vegetable is one of the most popular throughout the world and the one that Americans consume more of pound for pound than any other. Currently, the main producers of potatoes include the Russian Federation, Poland, India, China and the United States.

How to Select and Store

While potatoes are often conveniently packaged in a plastic bag, it is usually better to buy them individually from a bulk display. Not only will this allow you to better inspect the potatoes for signs of decay or damage, but many times, the plastic bags are not perforated and cause a build up of moisture that can negatively affect the potatoes.

Potatoes should be firm, well shaped and relatively smooth, and should be free of decay that often manifests as wet or dry rot. In addition, they should not be sprouting or have green coloration since this indicates that they may contain the toxic alkaloid *solanine* that has been found to not only impart an undesirable taste, but can also cause a host of different health conditions such as circulatory and respiratory depression, headaches and diarrhea.

Sometimes stores will offer already cleaned potatoes. These should be avoided since when their protective coating is removed by washing, potatoes are more vulnerable to bacteria. In addition, already cleaned potatoes are also more expensive, and since you will have to wash them again before cooking, you will be paying an unnecessary additional cost.

Since new potatoes are harvested before they are fully mature, they are much more susceptible to damage. Be especially careful when purchasing these to buy ones that are free from discoloration and injury.

The ideal way to store potatoes is in a dark, dry place between 45F to 50F (between 7-10C) as higher temperatures, even room temperature, will cause the potatoes to sprout and dehydrate prematurely. While most people do not have root cellars that provide this type of environment, to maximize the potato's quality and storage, you should aim to find a place as close as possible to these conditions. Storing them in a cool, dark closet or basement may be suitable alternatives. Potatoes should definitely not be exposed to sunlight as this can cause the development of the toxic alkaloid *solanine* to form.

Potatoes should not be stored in the refrigerator, as their starch content will turn to sugar giving them an undesirable taste. In addition, do not store potatoes near onions, as the gases that they each emit will cause the degradation of one another. Wherever you store them, they should be kept in a burlap or paper bag.

Mature potatoes stored properly can keep up to two months. Check on the potatoes frequently, removing any that have sprouted or shriveled as spoiled ones can quickly affect the quality of the others. New potatoes are much more perishable and will only keep for one week.

Cooked potatoes will keep fresh in the refrigerator for several days. Potatoes do not freeze well.

How to Enjoy

A Few Quick Serving Ideas

- Purée roasted garlic, cooked potatoes and olive oil together to make delicious garlic mashed potatoes. Season to taste.
- Potatoes are a featured ingredient in the classic dish, Salad Nicoise, that pairs new potatoes with chunks of tuna fish and steamed green beans dressed lightly with oil and vinegar.
- Toss steamed, diced potato with olive oil and fresh herbs of your choice.

For some of our favorite recipes, click Recipes.

Safety

Potatoes Belong to the Nightshade Family

Potatoes are one of the vegetables that belong to the nightshade (Solanaceae) family. For helpful information about nightshade vegetables—including our WHFoods Recommendations—please see our article, Which foods are classified as "nightshades," and is it true that foods from this group can potentially contain problematic substances?

Processed Potato Products and Acrylamides

Regularly cooked potatoes are not a concern when it comes to acrylamide, a potentially toxic and potentially cancer-causing substance. Yet, fried, processed foods made with potatoes—such as potato chips and french fries—are considered among the highest risk of foods when it comes to acrylamide exposure. This is yet another reason to avoid or minimize your intake of these foods. For more on acrylamides, see our detailed write-up on the subject.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Potatoes, baked **1.00 cup** **173.00 grams**				**Calories: 161** **GI: high**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin B6	0.54 mg	32	3.6	very good
potassium	925.55 mg	26	3.0	good
copper	0.20 mg	22	2.5	good
vitamin C	16.61 mg	22	2.5	good
manganese	0.38 mg	19	2.1	good
phosphorus	121.10 mg	17	1.9	good
vitamin B3	2.44 mg	15	1.7	good
fiber	3.81 g	15	1.7	good
pantothenic acid	0.65 mg	13	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Romaine lettuce

Not all lettuce is created equal, but if you start your meal with a salad made of romaine lettuce you will be sure to add not only a variety of textures and flavors to your meal but an enormous amount of nutritional value. Most of the domestic U.S. harvest of romaine lettuce and other salad greens comes from California and is available throughout the year.

Lettuce is synonymous with salads as they are predominantly made from crispy green lettuce leaves. Most varieties of lettuce exude small amounts of a white, milky liquid when their leaves are broken. This "milk" gives lettuce its slightly bitter flavor and its scientific name, Lactuca sativa derived from the Latin word for milk.

Romaine Lettuce, raw
2.00 cups
(94.00 grams)

Calories: 16
GI: very low

Nutrient	DRI/DV
vitamin K	107%
vitamin A	45%
folate	32%
molybdenum	13%
fiber	8%
manganese	8%
potassium	7%
copper	6%
vitamin B1	6%
biotin	6%
vitamin B2	5%
vitamin C	5%
omega-3 fats	5%
iron	5%
vitamin B6	4%
chromium	4%
phosphorus	4%
magnesium	3%
calcium	3%
pantothenic acid	3%

Health Benefits

Want to maximize the health benefits of your salads? Start with romaine lettuce for a salad guaranteed to be packed with nutrients. The vitamins, minerals, phytonutrients and fiber found in romaine lettuce are especially good for the prevention or alleviation of many common health complaints.

Due to its extremely low calorie content and high water volume, romaine lettuce—while often overlooked in the nutrition world—is actually a very nutritious food. Based on its nutrient richness, our food ranking system qualified it as an excellent source of vitamin A (notably through its concentration of the pro-vitamin A carotenoid, beta-carotene), vitamin K, folate, and molybdenum. Romaine lettuce also emerged from our ranking system as a very good source of dietary fiber, four minerals (manganese, potassium, copper, and iron), and three vitamins (biotin, vitamin B1, and vitamin C).

Salad Days Keep Your Heart Young

Romaine's vitamin C and beta-carotene content make it a heart-healthy green. Vitamin C and beta-carotene work together to prevent the oxidation of cholesterol. When cholesterol becomes oxidized, it becomes sticky and starts to build up in the artery walls forming plaques. If these plaques become too large, they can block off blood flow or break, causing a clot that triggers a heart attack or stroke. The fiber in Romaine lettuce adds another plus in its column of heart-healthy effects. In the colon, fiber binds to bile salts and removes them from the body. This forces the body to make more bile, which is helpful because it must break down cholesterol to do so. This is just one way in which fiber is able to lower high cholesterol levels.

Equally beneficial to heart health is Romaine's folic acid content. This B vitamin is needed by the body to convert a damaging chemical called *homocysteine* into other, benign substances. If not converted, homocysteine can directly damage blood vessels, thus greatly increasing the risk of heart attack and stroke. In addition, romaine lettuce is a very good source of potassium, which has been shown in numerous studies to be useful in lowering high blood pressure, another risk factor for heart disease. With its folic acid, vitamin C, beta-carotene, potassium, and fiber content, romaine lettuce can significantly contribute to a heart-healthy diet.

Description

The words lettuce and salad are practically interchangeable since most salads are made predominantly with the green crispy leaves of lettuce. Most varieties of lettuce exude small amounts of a white, milky liquid when their leaves are broken. This "milk" gives lettuce its slightly bitter flavor and its scientific name, *Lactuca sativa* since *Lactuca* is derived from the Latin word for milk.

Lettuce can be classified into various categories with the most common being:

- Romaine: Also known as Cos, this variety of head forming lettuce has deep green, long leaves with a crisp texture and deep taste.
- Crisphead: With green leaves on the outside and whitish ones on the inside, this variety of head lettuce has a crisp texture and a watery, mild taste. The best known variety of crisphead lettuce is iceberg.
- Butterhead: These types of lettuce feature tender large leaves that form a loosely arranged head that is easily separated from the stem, a sweet flavor and a soft texture. The best known varieties of Butterhead lettuce include Boston and Bibb.
- Leaf: Featuring broad, curly leaf varieties that are green and/or red, the leaf lettuces offer a delicate taste and a mildly crispy texture. Best known varieties of leaf lettuce include green leaf and red leaf.

While vegetables such as arugula, watercress and mizuna are not technically lettuce, these greens are often used interchangeably with lettuces in salads.

History

Native to the eastern Mediterranean region and western Asia, lettuce has a long and distinguished history. With depictions appearing in ancient Egyptian tombs, the cultivation of lettuce is thought to date back to at least 4500 BC. The ancient Greeks and Romans held lettuce in high regard both as a food and for its therapeutic medicinal properties.

In China, where lettuce has been growing since the 5th century, lettuce represents good luck. It is served on birthdays, New Year's Day and other special occasions. Christopher Columbus introduced varieties of lettuce to North America during his second voyage in 1493. Lettuce was first planted in California, the lettuce capital of the United States, by the Spanish missionaries in the 17th century. Its popularity across the US did not become widespread until centuries later with the development of refrigeration and railway transportation.

How to Select and Store

Regardless of the type, all lettuces should feature crisp looking, unwilted leaves that are free of dark or slimy spots. In addition, the leaves' edges should be free of brown or yellow discoloration. Lettuces such as Romaine and Boston should have compact heads and stem ends that are not too brown.

Since different types of lettuce have different qualities, different methods should be used when storing. Romaine and leaf lettuce should be washed and dried before storing in the refrigerator to remove their excess moisture, while Boston lettuce need not be washed before storing. A salad spinner can be very helpful in the drying of lettuce (and other salad ingredients as well). These lettuces should be either stored in a plastic bag or wrapped in a damp cloth and stored in the refrigerator crisper.

To store arugula, watercress and other types of salad greens that are sold with their roots attached, wrap the roots in a damp paper towel and place the entire greens in a plastic bag.

Romaine lettuce will keep for five to seven days, Boston and leaf lettuce for two to three days, while fragile greens such as arugula and watercress ideally should be prepared the day of purchase. All types of lettuce should be stored away from ethylene-producing fruits, such as apples, bananas and pears, since they will cause the lettuce leaves to brown.

How to Enjoy

A Few Quick Serving Ideas

- Give sandwiches extra crunch (and nutrients) by garnishing with lettuce leaves.
- When it comes to salads, the only limitation is your imagination. Be creative: use a variety of different lettuce types and add your favorite foods. Whether they're vegetables, fruits, seeds, nuts, whole grains, whole wheat croutons, soy products, meats or cheeses, most every food goes well with lettuce.
- For an interactive meal that is both unusual and fun, arrange nuts, diced vegetables, chicken and/or baked tofu and romaine lettuce leaves on a large plate. Everyone then has the chance to make their own lettuce pockets by placing their favorite fillings in a lettuce leaf and making a breadless sandwich wrap.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Romaine Lettuce, raw
2.00 cups
94.00 grams

Calories: 16
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin K	96.35 mcg	107	120.6	excellent
vitamin A	409.37 mcg RAE	45	51.2	excellent
folate	127.84 mcg	32	36.0	excellent
molybdenum	5.64 mcg	13	14.1	excellent
fiber	1.97 g	8	8.9	very good
manganese	0.15 mg	8	8.4	very good
potassium	232.18 mg	7	7.5	very good
biotin	1.79 mcg	6	6.7	very good
vitamin B1	0.07 mg	6	6.6	very good
copper	0.05 mg	6	6.3	very good
iron	0.91 mg	5	5.7	very good
vitamin C	3.76 mg	5	5.6	very good
vitamin B2	0.06 mg	5	5.2	good
omega-3 fats	0.11 g	5	5.2	good
vitamin B6	0.07 mg	4	4.6	good
phosphorus	28.20 mg	4	4.5	good
chromium	1.25 mcg	4	4.0	good
magnesium	13.16 mg	3	3.7	good
calcium	31.02 mg	3	3.5	good
pantothenic acid	0.13 mg	3	2.9	good

World's Healthiest Foods Rating	Rule

excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Sea vegetables

What's New and Beneficial about Sea Vegetables

- Sea vegetables may be a better source of bioavailable iron than previously thought. One tablespoon of dried sea vegetable will contain between 1/2 milligram and 35 milligrams of iron, and this iron is also accompanied by a measurable amount vitamin C. Since vitamin C acts to increase the bioavailability of plant iron, this combination in sea vegetables may offer a special benefit.
- Brown algae (including the commonly eaten sea vegetables kombu/kelp, wakame, and arame may be unique among the sea vegetables in their iodine content. Some species from the brown algae genus *Laminaria* are able to accumulate iodine in up to 30,000 times more concentrated a form than sea water!
- Sea vegetables may be a unique food source not only of the mineral iodine, but also of the mineral vanadium. As part of their natural defense mechanisms, sea vegetables contain a variety of enzymes called haloperoxidases. These enzymes all require vanadium in order to function. Although this mineral is not as well known as some of the other mineral nutrients, it appears to play a multi-faceted role in regulation of carbohydrate metabolism and blood sugar. While research in this area is still in the preliminary stage and remains mixed in terms of results, vanadium may help to increase our body's sensitivity to insulin by inhibiting a group of enzymes called protein tyrosine phosphatases. It may also help us decrease our body's production of glucose and help us increase our body's ability to store starch in the form of glycogen.
- Unlike some other types of vegetables, sea vegetables do not appear to depend solely on common polyphenol antioxidants (like flavonoids) or terpenoid antioxidants (like carotenoids) for their total antioxidant capacity. Recent research from India makes it clear that a variety of non-flavonoid and non-carotenoid antioxidant compounds are present in sea vegetables, including several different types of antioxidant alkaloids.
- An increasing number of health benefits from sea vegetables are being explained by their fucoidan concent. Fucoidans are starch-like (polysaccharide) molecules, but they are unique in their complicated structure (which involves a high degree of branching) and their sulfur content. Numerous studies have documented the anti-inflammatory benefits of fucoidans (sometimes referred to as sulfated polysaccharides), and osteoarthritis has been an area of specific interest for these anti-inflammatory benefits. The sulfated polysaccharides in sea vegetables also have anti-viral activity and have been studied in relationship to herpes simplex virus 1 (HSV-1) and herpes simplex virus 2 (HSV-2). By blocking the binding sites used by HSV-1 and HSV-2 for cell attachment, sulfated polysaccharides help prevent replication of these viruses. The sulfated polysaccharides in sea vegetables also have important anticoagulant and antithrombotic properties that bring valuable cardiovascular benefits.
- Sea vegetables may play a role in lowering risk of estrogen-related cancers, including breast cancer. Since cholesterol is required as a building block for production of estrogen, the cholesterol-lowering effects of sea vegetables may play a risk-reducing role in this regard. However, more interesting with respect to breast cancer risk is the apparent ability of sea vegetables to modify aspects of a woman's normal menstrual cycle in such a way that over a lifetime, the total cumulative estrogen secretion that occurs during the follicular phase of the cycle gets decreased. For women who are at risk of estrogen-sensitive breast cancers, sea vegetables may bring a special benefit in this regard.

WHFoods Recommendations

While the broad range of minerals provided by sea vegetables make them a great addition to your Healthiest Way of Eating, Westerners are often not quite sure how to add more of these nutrient-rich foods to their meals. One easy way is to keep a container of kelp flakes on the dinner table and use it instead of table salt for seasoning foods. You can also experiment with adding your favorite sea vegetable to vegetable dishes, salads, and miso soups. They are easy to add to dishes as they require no cooking (see Tips for Preparing Sea Vegetables in the How to Enjoy section below). It is recommended to include 1 tsp of sea vegetables to your Healthiest Way of Eating each day.

Sea Vegetables, dulse, dried
1.00 TBS
(5.00 grams)

Calories: 11
GI: low

Nutrient	DRI/DV
iodine	500%
vitamin C	16%
manganese	16%
vitamin B2	11%
vitamin A	9%

copper	9%
protein	4%
phosphorus	3%
iron	3%
potassium	3%
zinc	3%
vitamin B3	3%
vitamin B6	3%
vitamin B1	3%
pantothenic acid	3%

Health Benefits

Why would anyone want to eat sea vegetables? Because they offer one of the broadest ranges of minerals of any food, containing virtually all the minerals found in the ocean—and not surprisingly, many of same minerals found in human blood. The also offer a variety of unique phytonutrients, including their sulfated polysaccharides (also called fucoidans). Unlike some other categories of vegetables, sea vegetables do not appear to depend on carotenoids and flavonoids for their antioxidant benefits, because in additional to these two important categories of antioxidants, sea vegetables contain several other types, including alkaloid antioxidants.Sea vegetables are an excellent source of iodine, vitamin C, manganese, and vitamin B2. They are also a very good source of vitamin A (in the form of carotenoids) and copper as well as a good source of protein, pantothenic acid, potassium, iron, zinc, vitamin B6, niacin, phosphorus, and vitamin B1.

Multiple Benefits from Sulfated Polysaccharides

To understand many of the anti-inflammatory, anti-cancer, anticoagulant, antithrombotic, and antiviral properties of sea vegetables, you need to look no further than their sulfated polysaccharides. These unique compounds (also called fucoidans) are starch-like molecules that are unusual in their complexity. Unlike many other types of polysaccharides, the fucoidans contain many chemical "branch points," and they also contain sulfur atoms. Multiple studies show anti-inflammatory benefits from consumption of the sulfated polysaccharides in sea vegetables. Some of these benefits appear to take place through the blocking of selectins and from inhibition of an enzyme called phospholipase A2. Selectins are sugar-protein molecules (glycoproteins) that run through cell membranes. During inflammatory responses by the body, selectins are important in allowing inflammatory signals to be transmitted through the cell. By blocking selectin function, some of the inflammatory signaling can be lessened. In case of chronic, unwanted inflammation, this blocking of selectin-related signals can provide important health benefits. Interest in this aspect of sea vegetable intake and anti-inflammatory benefits has received special focus in the area of osteoarthritis. More widely present in unwanted inflammatory problems is overactivity of the enzyme phospholipase A2 (PLA2). This enzyme is important for creation of the omega-6 fatty acid called arachidonic acid (AA), and AA is itself the basic building block for a wide variety of pro-inflammatory messaging molecules. Many corticosteroid medications lower inflammation by blocking PLA2, as does licorice, turmeric, and the flavonoid quercetin. The association of sulfated polysaccharides with decreased PLA2 activity may be especially important in the anti-inflammatory benefits of sea vegetables.

Sea vegetables' sulfated polysaccharides are also associated with its anti-viral activity. Best studied in this area is the relationship between sulfated polysaccharides and herpes simplex virus 1 (HSV-1) and herpes simplex virus 2 (HSV-2). By blocking the binding sites used by HSV-1 and HSV-2 for cell attachment, sulfated polysaccharides help prevent replication of these viruses. It's important to point out that none of these HSV and sea vegetable studies have involved individuals with HSV who incorporated sea vegetables into their diet. Instead, the studies have been conducted in the lab using human fibroblast cells inoculated with HSV. We don't yet know whether dietary sea vegetables will help prevent HSV replication in individuals with HSV, even though we greatly look forward to future research results obtained in clinical studies with individuals who have HSV and add sea vegetables to their diet.

Many of the cardiovascular benefits of sea vegetables can also be attributed to their sulfated polysaccharide content. Extracts from sea vegetables are sometimes referred to as "heparin-like extracts" because they exhibit some of the same properties as this widely used anticoagulant medication. In fact, heparin itself can be described as a sulfated polysaccharide, and like the sulfated polysaccharides found in sea vegetables, it can decrease the tendency of blood platelet cells to coagulate and form clots. (A blood clot can also be called a "thrombus"—thus giving rise to the term "antithrombotic" in description of sulfated polysaccharides.) In addition to their anticoagulant and antithrombotic benefits, however, sea vegetables have also been shown to help lower total cholesterol and LDL cholesterol and to improve cardiovascular health in this way.

Anti-Cancer Benefits

Not fully understood but of increasing interest to researchers are the anti-cancer benefits of sea vegetables. Research interest in this area has tended to focus on colon cancer, with a special emphasis on the loss of calcium-sensing receptors (CaSRs) in colon cancer cells, and the ability of sea vegetable extracts to alter CaSR-related events. But since chronic, unwanted inflammation and chronic oxidative stress are both risk factors for development of cancer, it would be quite natural for scientists to be interested in sea vegetables are anti-cancer foods not only in the case of colon cancer, but for other types of cancer as well. Sea vegetables are well-researched as containing a variety of anti-inflammatory and antioxidant compounds, and this nutrient combination is likely to result in some risk-lowering benefits in the case of colon cancer and other cancer types. Although much more research is needed in this area, we expect the anti-caner benefits of sea vegetables to become more firmly established over time.

Of special note in this area of cancer and sea vegetables is the issue of estrogen-related cancers, especially breast cancer. Intake of sea vegetables appears able to modify various aspects of a woman's normal menstrual cycle in such a way that over long periods of time (tens of years) the total cumulative estrogen secretion that occurs during the follicular phase of the cycle gets reduced. Since overproduction of estrogen can play a role in the risk of breast cancer for women who are estrogen-sensitive, sea vegetables may offer unique benefits in this regard. It's also important to note that cholesterol is required as a building block for production of estrogen, and intake of sea vegetables has repeatedly been shown to lower blood levels of total cholesterol and LDL-cholesterol.

Other Benefits

Array of Minerals

Sea vegetables have been rightly singled out for their unique mineral content. You're going to find measurable amounts of calcium, copper, iodine, iron, magnesium, manganese, molybdenum, phosphorus, potassium, selenium, vanadium, and zinc in sea vegetables, and in some cases (like iodine) you can simply not find a more concentrated mineral source. Brown algae like kombu/kelp, wakame, and arame can be particularly concentrated sources of iodine, and for some health conditions - like hypothyroidism, in which the cells of the thyroid make too little thyroid hormone - increased iodine intake can provide important health benefits. The wide variety of minerals found in sea vegetables is simply not found among most other vegetable groups.

The vanadium content of sea vegetables is an area of special interest with respect to their mineral content. While research in this area remain inconclusive, sea vegetables may be able to help us increase our cells' sensitivity to insulin, help us prevent overproduction of glucose by our cells, and help us take existing blood sugars and convert them into storable starches. All of these factors would help us increase our blood sugar control, and lower our risk of type 2 diabetes.

Concentration of Iron

Sea vegetables may turn out to be a better source of bioavailable iron than previously thought. One tablespoon of dried sea vegetable is likely to contain between 1/2 milligram and 35 milligrams of iron. At the lower end of this range, the iron content of sea vegetables is not really significant. But at the higher end of this range, the amount of iron found in sea vegetables is outstanding. (As an overall iron rating in our food rating system, we describe sea vegetables as being a "good" source of iron.) The iron found in sea vegetables is also accompanied by a measurable amount vitamin C. Since vitamin C acts to increase the bioavailability of plant iron, this combination in sea vegetables may offer a special benefit.

Antioxidant Potential

The antioxidant content of sea vegetables also deserves mention with respect to its health benefits. While sea vegetables do contain measurable amounts of polyphenols like carotenoids and flavonoids, they also contain other phytonutrient antioxidants, including several types of alkaloids that have been shown to possess antioxidant properties. Coupled with measurable amounts of antioxidant vitamins (like vitamins C and E) and antioxidant minerals (like manganese and zinc), sea vegetables can be expected to help us reduce our risk of unwanted oxidative stress and many types of cardiovascular problems that are associated with poor antioxidant intake.

Description

Western cultures are only recently beginning to enjoy the taste and nutritional value of sea vegetables, often referred to as seaweed, which have been a staple of the Japanese diet for centuries. Numerous various varieties of sea vegetables can be found in health food and specialty stores throughout the year. Owing to their rise in popularity, they are also becoming much easier to find in local supermarkets as well.

Sea vegetables can be found growing both in the marine salt waters as well as in fresh water lakes and seas. They commonly grow on coral reefs or in rocky landscapes and can grow at great depths provided that sunlight can penetrate through the water to where they reside since, like plants, they need light for their survival. Sea vegetables are neither plants nor animals but classified in a group known as algae.

There are thousands of types of sea vegetables, which are classified into categories by color, known either as brown, red or green sea vegetables. Each is unique, having a distinct shape, taste and texture. Although not all sea vegetables that exist are presently consumed, a wide range of sea vegetables are enjoyed as foods. Because Japan remains one of the world's largest sea vegetable producers and exporters, the Japanese names for sea vegetables are among the most common names found in grocery stores throughout the United States. The words we use to describe most commonly eaten sea vegetables like nori, hijiki, wakame, arame, and kombu are Japanese. Dulse, however, is of Gaelic origin.

Many people aren't sure exactly what is meant by the word "kelp," even though they associate it with sea vegetables. This word is often used very loosely to refer to any type of sea vegetable. However, when it's used in a scientific way, the word "kelp" refers specifically to the family of large brown algae and specifically to a variety of brown algae species that are found within the genus Laminaria.

Here is a little more information about some of the most popular types of sea vegetables: *Nori*: dark purple-black color that turns phosphorescent green when toasted, famous for its role in making sushi rolls *Kelp*: light brown to dark green in color, oftentimes available in flake form *Hijiki*: looks like small strands of black wiry pasta, has a strong flavor *Kombu*: very dark in color and generally sold in strips or sheets, oftentimes used as a flavoring for soups *Wakame*: similar to kombu, most commonly used to make Japanese miso soup *Arame*: this lacy, wiry sea vegetable is sweeter and milder in taste than many others *Dulse*: soft, chewy texture and a reddish-brown color

On the science side of the equation, here is a brief chart showing basic types of sea vegetables and some of their most commonly eaten varieties:

Sea Vegetables From a Science Standpoint

	Green Algae	**Brown Algae**	**Red Algae**
Scientific Name	Chlorophycophyta	Phaeophycophyta	Rhodophycophyta
Approximate Number of Species	7,000	4,000	2,000
Commonly Eaten Forms	sea lettuce	kombu/kelp (*Laminaria* genus)	nori (*Porphyra* genus)
		wakame (*Undaria* genus)	agar-agar (*Euchema* genus)
		arame (*Eisenia* genus)	dulse (*Palmaria* genus)
		hijiki (*Hijikia* genus)	
Other Well-Studied Forms	*Caulerpa* genus, *Ulva* genus, *Chetomorpha* genus	*Sargassum* genus, *Padina* genus, *Fucus* genus (Atlantic brown kelp, also called bladderwrack)	*Euchema* genus, *Gracilaria* genus, *Gelidiella* genus, *Plocamium* genus, *Lithothamnium* genus, *Kappaphycus* genus

History

The consumption of sea vegetables enjoys a long history throughout the world. Archaeological evidence suggests that Japanese cultures have been consuming sea vegetables for more than 10,000 years. In ancient Chinese cultures, sea vegetables were a noted delicacy, suitable especially for honored guests and royalty. Korea, Vietnam, and Malaysia are other Asian countries where sea vegetables are widely consumed. Yet, sea vegetables were not just limited to being a featured part of Asian cuisines. In fact, most regions and countries located by waters, including Scotland, Ireland, Norway, Iceland, New Zealand, the Pacific Islands and coastal South American countries have been consuming sea vegetables since ancient times.

How to Select and Store

Look for sea vegetables that are sold in tightly sealed packages. Avoid those that have evidence of excessive moisture. Some types of sea vegetables are sold in different forms. For example, nori can be found in sheets, flakes, or powder. Choose the form of sea vegetables that will best meet your culinary needs.

Store sea vegetables in tightly sealed containers at room temperature where they can stay fresh for at least several months.

How to Enjoy

A Few Quick Serving Ideas

Make homemade vegetable sushi rolls by wrapping rice and your favorite vegetables in sheets of nori.

Slice nori into small strips and sprinkle on top of salads.

Combine soaked hijiki with shredded carrots and ginger. Mix with a little olive oil and soy sauce

- Shiitake Mushroom Seaweed Soup
- Spicy Healthy SautéedTofu
- Cucumber Seaweed Salad
- Kale with Hijiki
- Seaweed Rice

Safety

Sea vegetables have been a topic of ongoing debate and research concern involving heavy metals. In the world of marine biology and marine ecology, sea vegetables are widely recognized as plants with an excellent ability to take up minerals from the water and hold onto these minerals in their cells. This ability makes sea vegetables a rich source of many wonderful minerals, including magnesium, calcium, iron, and iodine. However, in waters that have become polluted with heavy metal elements—including arsenic, lead, and cadmium - sea vegetables can also act like a sponge in absorbing these unwanted contaminants. Some marine ecologists actually use sea vegetables as a kind of "biomonitor" to determine levels of heavy metal pollution in bodies of water.

Among all of the heavy metals, arsenic appears to be most problematic when it comes to sea vegetable toxicity risk. Virtually all types of sea vegetables have been determined to contain traces of arsenic. These types include arame, hijiki, kombu, nori, and wakame. Among all types of sea vegetable, however, hijiki stands out as being particularly high-risk when it comes to arsenic exposure. During the period 2000-2005, government-related agencies in England, New Zealand, and Canada issued public health recommendations advising against consumption of hijiki sea vegetable unless verified as containing very low levels of inorganic arsenic. Based on these reports, we recommend avoidance of hijiki as a sea vegetable unless available in the form of certified organic hijiki.

Although regulations for sea vegetables at the National Organics Program at the U.S. Department of Agriculture (USDA) are in a state of partial review, there are two types of certified organic sea vegetables currently available in the marketplace. Some certified organic sea vegetables have been farmed in a process that's usually referred to as "aquaculture" or "mariculture" and that involves a closely-monitored, contained-water environment for the sea vegetables. Other certified organic sea vegetables have been wild-harvest, but typically in regions where ocean waters are better protected against contaminants. In both cases, you're much more likely to get a low level of contaminants like arsenic (or no arsenic contamination whatsoever) by selecting certified organic hijiki (or any other sea vegetable). To assure yourself of no arsenic contamination whatsoever, you'll need to find a certified organic product that reports lab testing on the packaging and specifically indicates an arsenic-free status.

The levels of arsenic found in other types of sea vegetable have been relatively small. The U.S. Environmental Protection Agency (EPA) has set an oral Reference Dose (RfD) for arsenic exposure of 0.3 micrograms per kilogram of body weight per day. For a person weighing 154 pounds, that amount translates into 21 micrograms of arsenic. In research on sea vegetables, sea vegetable-containing supplements (like kelp supplements) are better studied than fresh sea vegetables, so it can be helpful to look at sea vegetable supplement data when trying to evaluate the arsenic risk from sea vegetables. In multiple research studies, the amount of arsenic present in one tablespoon (10 grams) of kelp has averaged about 4-5 micrograms, or approximately 20-25% of the RfD. While this level of arsenic intake is well beneath the EPA's threshold for daily oral intake, it may still be an amount that some persons wish to avoid. Your only guarantee for avoiding this arsenic exposure is to find and purchase sea vegetables that have been specifically tested for arsenic content and report arsenic-free contents on the packaging.

As described earlier, you are also much more likely to get a low level of arsenic exposure (or no arsenic exposure at all) by selecting of certified organic sea vegetables.

Because 20% of all foodborne disease is associated with seafood intake, and half of these seafood-related disease problems involve toxins from algae, it's also important to understand the relationship between sea vegetables (very large algae) and algae that occur in other forms. Harmful algal blooms (HABs), or what were previously referred to as "red tides," involve unwanted changes in the sea environment in which very small, one-celled algae become too plentiful. These small, one-celled algae come in the form of dinoflagellates and diatoms. These one-celled algae are capable of producing certain types of compounds (for example, saxitoxins) that can be harmful to humans. Filter-feeding shellfish (like oysters and clams) can ingest large amounts of these small, one-celled algae and can serve to pass on their potential toxins in more concentrated form to humans. "Shellfish poisoning" is the general name given to this set of events. While shellfish poisoning is an important health problem in and of itself, it is a different type of problem than the problem of potential heavy metal residues found in sea vegetables, and the toxin-related risks associated with shellfish poisoning should not be confused with heavy metal risks associated with sea vegetables.

We continue to include sea vegetables among the World's Healthiest Foods because of their incredibly rich mineral content and other unique health benefits, and because the toxicity risks described above can be prevented through the purchase of certified organic sea vegetables! Because most certified organic sea vegetables can be purchased in dried form and reconstituted at home, they can often be ordered from outside of your local area and shipped to you at a relatively low cost.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Sea Vegetables, dulse, dried
1.00 TBS
5.00 grams

Calories: 11
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
iodine	750.00 mcg	500	829.5	excellent
vitamin C	12.16 mg	16	26.9	excellent
manganese	0.31 mg	16	25.7	excellent
vitamin B2	0.14 mg	11	17.9	excellent
vitamin A	81.05 mcg RAE	9	14.9	very good
copper	0.08 mg	9	14.7	very good
protein	1.81 g	4	6.0	good
pantothenic acid	0.16 mg	3	5.3	good
potassium	110.96 mg	3	5.3	good
iron	0.56 mg	3	5.2	good
zinc	0.33 mg	3	5.0	good
vitamin B6	0.05 mg	3	4.9	good
vitamin B3	0.46 mg	3	4.8	good
phosphorus	18.05 mg	3	4.3	good
vitamin B1	0.03 mg	3	4.1	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
	DRI/DV>=50% OR

very good	Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Spinach

What's New and Beneficial About Spinach

- Bright, vibrant-looking spinach leaves are not only more appealing to the eye but more nourishing as well. Recent research has shown that spinach leaves that look fully alive and vital have greater concentrations of vitamin C than spinach leaves that are pale in color. The study authors suggest that the greater supply of vitamin C helps protect all of the oxygen-sensitive phytonutrients in the spinach leaves and makes them looking vibrant and alive.
- Many people are concerned about the nutrient content of delicate vegetables (like baby spinach) when those vegetables are placed in clear plastic containers in grocery store display cases and continuously exposed to artificial lighting. One recent food study has shown that you don't need to worry about the overall status of antioxidants in baby spinach that has been stored and displayed in this way. In this scientific study, the overall nutrient richness of the baby spinach when exposed to constant light was actually higher than the overall nutrient richness of baby spinach leaves kept in total darkness. The period of time in the study was 9 days, and the spinach was kept at 39°F/4°C (a temperature on the lower end of the scale for most home refrigerators). These findings are good news for anyone purchasing baby spinach in "ready-to-eat" containers.
- One new category of health-supportive nutrients found in spinach is called "glycoglycerolipids." Glycoclycerolipids are the main fat-related molecules in the membranes of light-sensitive organs in most plants. They're indispensable for the process of photosynthesis carried out by plants. However, recent lab research in laboratory animals has shown that glycoglycerolipids from spinach can help protect the lining of the digestive tract from damage — especially damage related to unwanted inflammation. You can expect to see more studies about this exciting new category of molecules in spinach and its potential health benefits.
- In a recent study on the relationship between risk of prostate cancer and vegetable intake — including the vegetables spinach, broccoli, cauliflower, cabbage, Brussels sprouts, mustard greens, turnip greens, collards, and kale — only spinach showed evidence of significant protection against the occurrence of aggressive prostate cancer. ("Aggressive prostate cancer" was defined as stage III or IV prostate cancer with a Gleason score of at least 7. Gleason scores are based on lab studies of prostate tissue and common tumor-related patterns.) The study authors did not speculate about specific substances in spinach that may have been involved in decreased prostate cancer risk. However, we know that certain unique anti-cancer carotenoids—called epoxyxanthophylls — are plentiful in spinach, even though they may not be as effectively absorbed as other carotenoids like beta-carotene and lutein. You can count on seeing future research on neoxanthin and violaxanthin — two anti-cancer epoxyxanthophylls that are found in plentiful amounts in the leaves of spinach.

WHFoods Recommendations

Among the World's Healthiest vegetables, spinach comes out at the top of our ranking list for nutrient richness. Rich in vitamins and minerals, it is also concentrated in health-promoting phytonutrients such as carotenoids (beta-carotene, lutein, and zeaxanthin) and flavonoids to provide you with powerful antioxidant protection. Enjoy baby spinach in your favorite salads or make a salad made exclusively of baby spinach. Spinach is one of only three vegetables that we recommend boiling to help reduce its concentration of oxalic acid. We recommend boiling for just 1 minute to minimize loss of nutrients and flavor. For more on the Healthiest Way of Cooking Spinach, see the How to Enjoy section below.

Foods belonging to the chenopod family—including beets, chard, spinach and quinoa—continue to show an increasing number of health benefits not readily available from other food families. The red and yellow betalain pigments found in this food family, their unique epoxyxanthophyll carotenoids, and the special connection between their overall phytonutrients and our nervous system health (including our specialized nervous system organs like the eye) point to the chenopod family of foods as unique in their health value. While we have yet to see large-scale human studies that point to a recommended minimum intake level for foods from this botanical family, we have seen data on chenopod phytonutrients, and based on this data, we recommend that you include foods from the chenopod family in your diet 1-2 times per week. In the case of a leafy food like spinach, we recommend a serving size of at least 1/2 cup, and even more beneficial, at least one full cup.

Spinach, cooked
1.00 cup
(180.00 grams)

Calories: 41
GI: very low

Nutrient	DRI/DV
vitamin K	987%
vitamin A	105%

manganese	84%
folate	66%
magnesium	39%
iron	36%
copper	34%
vitamin B2	32%
vitamin B6	26%
vitamin E	25%
calcium	24%
vitamin C	24%
potassium	24%
fiber	17%
vitamin B1	14%
phosphorus	14%
zinc	12%
protein	11%
choline	8%
omega-3 fats	7%
vitamin B3	6%
selenium	5%
pantothenic acid	5%

Health Benefits

We all know that Popeye made himself super strong by eating spinach, but you may be surprised to learn that he may also have been helping to protect himself against inflammatory problems, oxidative stress-related problems, cardiovascular problems, bone problems, and cancers at the same time.

Anti-Inflammatory and Anti-Cancer Benefits from Spinach Phytonutrients

Even though virtually all vegetables contain a wide variety of phytonutrients—including flavonoids and carotenoids—spinach can claim a special place among vegetables in terms of its phytonutrient content. Researchers have identified more than a dozen different flavonoid compounds in spinach that function as anti-inflammatory and anti-cancer agents. (Some of these substances fall into a technical category of flavonoids known as *methylenedioxyflavonol glucuronides*.) The anticancer properties of these spinach flavonoids have been sufficiently impressive to prompt researchers to create specialized spinach extracts that could be used in controlled laboratory studies. These spinach extracts have been shown to slow down cell division in human stomach cancer cells (gastric adenocarcinomas), and in studies on laboratory animals, to reduce skin cancers (skin papillomas). A study on adult women living in New England in the late 1980s also showed intake of spinach to be inversely related to incidence of breast cancer.

Excessive inflammation, of course, typically emerges as a risk factor for increased cancer risk. (That's why many anti-inflammatory nutrients can also be shown to have anti-cancer properties.) But even when unrelated to cancer, excessive inflammation has been shown to be less likely following consumption of spinach. Particularly in the digestive tract, reduced inflammation has been associated not only with the flavonoids found in spinach, but also with its carotenoids. Neoxanthin and violaxanthin are two anti-inflammatory epoxyxanthophylls that are found in plentiful amounts in the leaves of spinach. While these unique carotenoids may not be as readily absorbed as carotenoids like beta-carotene or lutein, they still play an important role in regulation of inflammation and are present in unusual amounts in spinach.

Decreased risk of aggressive prostate cancer is one health benefit of spinach consumption that should not be overlooked when talking about the anti-cancer properties of spinach. "Aggressive prostate cancer" is defined as stage III or IV prostate cancer which carries with it a Gleason score of at least 7. (Gleason scores are prostate cancer rating measurements that require lab studies of prostate tissue and evaluation of common tumor-related patterns.) Interestingly, in a recent study that evaluated possible prostate cancer-prevention benefits from a variety of vegetables including spinach, broccoli, cauliflower, cabbage, Brussels sprouts, mustard and turnip greens, collards, and kale — only spinach showed evidence of significant protection against the occurrence of aggressive prostate cancer.

Antioxidant Benefits of Spinach

Most of the flavonoid and carotenoid nutrients found in spinach that provide anti-inflammatory benefits provide antioxidant benefits as well. Given the fact that spinach is an excellent source of other antioxidant nutrients — including vitamin C, vitamin E, vitamin A (in the form of carotenoids), and manganese —as well as a very good source of the antioxidant zinc and a good source of the antioxidant selenium—it's no wonder that spinach helps lower risk of numerous health problems related to oxidative stress. Our blood vessels, for example, are especially susceptible to damage from oxidative stress, and intake of spinach has been associated with decreased risk of several blood vessel-related problems, including atherosclerosis and high blood pressure. (Interestingly, the blood pressure benefits of spinach may be related not only to its antioxidants, but also to some of its special peptides. Peptides are small pieces of protein, and researchers have discovered several peptides in spinach that can help lower blood pressure by inhibiting an enzyme called angiotensin I-converting enzyme.)

Two of the carotenoids that are especially plentiful in spinach — lutein and zeaxanthin — are primary antioxidants in several regions of the eye, including the retina and the macula. Although we haven't seen specific studies on spinach intake and prevention of eye-related problems like macular degeneration, we have seen studies showing that human blood levels of lutein can be increased by consumption of spinach in everyday amounts. We've also seen at least one group of researchers suggesting that spinach has a likely role to play in prevention of eye problems, including age-related macular degeneration.

Helping You Bone Up

The wealth of vitamin K provided by spinach is important for maintaining bone health. Vitamin K1 helps prevent excessive activation of osteoclasts, the cells that break down bone. Additionally, friendly bacteria in our intestines convert vitamin K1 into vitamin K2, which activates osteocalcin, the major non-collagen protein in bone. Osteocalcin anchors calcium molecules inside of the bone. All of these vitamin K-related mechanisms point to the importance of vitamin K-rich foods for bone health, and it is difficult to find vegetables that are richer in vitamin K than spinach. (On our World's Healthiest Foods list, only kale provides more micrograms of vitamin K per cup.) Spinach is also an excellent source of other bone-supportive nutrients including calcium and magnesium.

So while spinach probably won't make you super strong the minute you eat it, as it did for Popeye, it will promote your health and vitality in many other ways. It seems like Popeye was pretty smart after all.

Description

Calorie for calorie, leafy green vegetables like spinach with its delicate texture and jade green color provide more nutrients than any other food. Although spinach is available throughout the year, its season runs from March through May and from September through October when it is the freshest, has the best flavor, and is most readily available. Spinach belongs to the same family (*Amaranthaceae-Chenopodiaceae*) as Swiss chard and beets and has the scientific name, *Spinacia oleracea*. It shares a similar taste profile with these two other vegetables, having the bitterness of beet greens and the slightly salty flavor of Swiss chard.

Popeye popularized spinach, but it's too bad he ate it out of a can. Fresh spinach retains the delicacy of texture and green color that is lost when spinach is processed. Raw spinach has a mild, slightly sweet taste that can be refreshing in salads, while its flavor becomes more acidic and robust when it is cooked.

There are three different types of spinach generally available. Savoy has crisp, creased curly leaves that have a springy texture. Smooth-leaf has flat, unwrinkled, spade-shaped leaves, while semi-savoy is similar in texture to savoy but is not as crinkled in appearance. Baby spinach is great for use in salads owing to its taste and delicate texture.

History

Spinach is thought to have originated in ancient Persia (Iran). Spinach made its way to China in the 7th century when the king of Nepal sent it as a gift to this country. Spinach has a much more recent history in Europe than many other vegetables. It was only brought to that continent in the 11th century, when the Moors introduced it into Spain. In fact, for a while, spinach was known as "the Spanish vegetable" in England.

Spinach was the favorite vegetable of Catherine de Medici, a historical figure in the 16th century. When she left her home of Florence, Italy, to marry the king of France, she brought along her own cooks, who could prepare spinach the ways that she especially liked. Since this time, dishes prepared on a bed of spinach are referred to as "a la Florentine."

Spinach grows well in temperate climates. Today, the United States and the Netherlands are among the largest commercial producers of spinach.

How to Select and Store

Choose spinach that has vibrant deep green leaves and stems with no signs of yellowing. The leaves should look fresh and tender, and not be wilted or bruised. Avoid those that have a slimy coating as this is an indication of decay.

Do not wash spinach before storing as the exposure to water encourages spoilage. Place spinach in a plastic storage bag and wrap the bag tightly around the spinach, squeezing out as much of the air as possible. Place in refrigerator where it will keep fresh for up to 5 days.

Avoid storing cooked spinach as it will not keep very well.

How to Enjoy

A Few Quick Serving Ideas

- Add layers of spinach to your next lasagna recipe.
- Pine nuts are a great addition to cooked spinach.
- Spinach salads are a classic easy and delicious meal or side dish.

WHFoods Recipes That Feature Spinach

- Poached Egg over Spinach
- Poached Eggs over Spinach & Mushrooms
- Mediterranean Baby Spinach Salad
- Warm Spinach Salad with Tuna
- Indian-Style Lentils
- Figs, Walnuts and Spinach Salad
- 1-Minute Spinach
- Golden Spinach and Sweet Potato Healthy Sauté

Safety

Spinach and *E. coli*

Several national recalls of spinach-containing products between 2006-2013 have raised consumer concerns about the risk of spinach contamination with *E. coli* bacteria. Of special concern have been Shiga toxin-producing *E. coli* (STEC), including *E. coli 0157:H7*. Thorough washing of contaminated spinach cannot remove *E. coli 0157:H7*. However, as summarized by the U.S. Food and Drug Administration (FDA), "Cooking fresh spinach at 160°F (71°C) for 15 seconds will kill any *E. coli 0157:H7* present." The cooking method we recommend on our website for spinach—a quick boil for approximately 1 minute —greatly exceeds this safety standard.

Because many people enjoy spinach in raw form (especially baby spinach), we are often asked about the level of risk involved with consumption of raw spinach. While we have not seen enough data to provide you with an exact risk level here, there is definitely some level of risk involved—although it might be very small—with consumption of raw spinach. If your goal is to remove this risk entirely, your best approach is to follow our quick boil cooking method for spinach.

In the case of certified organic raw spinach (and other certified organic raw vegetables), there is one regulation working to help lower contamination risk: raw animal manure cannot be used less than 120 days prior to harvest of a certified organic food if the food (like spinach) has an edible portion that comes into contact with the soil or soil surface. This restriction on the use of raw animal manure can help prevent crops like spinach from being contaminated with bacteria like *E. coli 0157:H7*. In the case of non-organic raw spinach, there can also be reduction of risk due to irradiation of the spinach—a practice allowed by the FDA since 2008. (Since irradiation is a prohibited practice in the production of certified organic foods, however, certified organic raw spinach is not irradiated.)

Oxalate Content

Spinach has consistently been determined to have high oxalate content. Oxalates are naturally occurring organic acids found in a wide variety of foods, and in the case of certain medical conditions, they must be greatly restricted in a meal plan to prevent over-accumulation inside the body. Our comprehensive article about oxalates will provide you with practical and detailed information about these organic acids, food, and health.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Spinach, cooked
1.00 cup
180.00 grams

Calories: 41
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin K	888.48 mcg	987	429.2	excellent
vitamin A	943.29 mcg RAE	105	45.6	excellent
manganese	1.68 mg	84	36.5	excellent
folate	262.80 mcg	66	28.6	excellent
magnesium	156.60 mg	39	17.0	excellent
iron	6.43 mg	36	15.5	excellent
copper	0.31 mg	34	15.0	excellent
vitamin B2	0.42 mg	32	14.0	excellent
vitamin B6	0.44 mg	26	11.3	excellent
vitamin E	3.74 mg (ATE)	25	10.8	excellent
calcium	244.80 mg	24	10.6	excellent
potassium	838.80 mg	24	10.4	excellent
vitamin C	17.64 mg	24	10.2	excellent
fiber	4.32 g	17	7.5	very good
phosphorus	100.80 mg	14	6.3	very good
vitamin B1	0.17 mg	14	6.2	very good
zinc	1.37 mg	12	5.4	very good
protein	5.35 g	11	4.7	very good
choline	35.46 mg	8	3.6	very good
omega-3 fats	0.17 g	7	3.1	good
vitamin B3	0.88 mg	6	2.4	good
pantothenic acid	0.26 mg	5	2.3	good
selenium	2.70 mcg	5	2.1	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Squash, summer

The delicate flavor, soft shell and creamy white flesh of summer squash is a perfect addition to any summer meal. While especially plentiful in the U.S. marketplace during the summer months, summer squash is actually available through the year. Summer squashes, members of the *Cucurbitaceae* family and relatives of both the melon and the cucumber, come in many different varieties. While each variety may have a distinct shape, color, size and flavor, all varieties share some common characteristics. Regardless of variety, all parts of summer squash are edible, including the flesh, seeds and skin. Some varieties of squash also produce edible flowers. Unlike winter squash, summer squash are more fragile and cannot be stored for long periods of time unless frozen. For Native Americans, squashes were considered as one of the "three sisters" along with corn (maize) and beans.

What's New and Beneficial about Summer Squash

- Although summer squash has long been recognized as an important food source of carotenoids, only recently have research studies documented just how fantastic summer squash can be when it comes to these key antioxidants. For some groups of study participants, summer squash turns out to be the primary food source of alpha-carotene and beta-carotene in the entire diet! For lutein, zeaxanthin, and beta-cryptoxanthin (three other health-supportive carotenoids) summer squash also comes out among the top three food sources in several studies.
- When we think about food and antioxidants, what first comes to mind might be fresh fruit and vitamin C, or bright orange carrots and beta-carotene. Yet several recent studies have underscored the unique contribution made by summer squash to our antioxidant requirements. While not as rich in some of the more widely-publicized antioxidants like beta-carotene, summer squash is a very strong source of other key antioxidant nutrients, including the carotenoids lutein and zeaxanthin. Since the skin of this food is particularly antioxidant-rich, it's worth leaving the skin intact and purchasing organic summer squash to help avoid potential unwanted contaminants.
- We tend to think about squashes, both summer and winter, as starchy vegetables. This thinking is correct, since about 85-90% of the total calories in squashes (as a group) come from carbohydrate, and about half of this carbohydrate is starch-like in composition and composed of polysaccharides. But we also tend to think about polysaccharides as stagnant storage forms for starch that cannot do much for us in terms of unique health benefits. Here our thinking is way off target! Recent research has shown that the polysaccharides in summer squash include an unusual amount of pectin—a specially structured polysaccharide that often include special chains of D-galacturonic acid called homogalacturonan. It's this unique polysaccharide composition in summer squash that is being linked in repeated animal studies to protection against diabetes and better regulation of insulin. We expect to see future studies on humans confirming these same types of benefits from consumption of summer squash.

Summer Squash, sliced, cooked
1.00 cup
(180.00 grams)

Calories: 36
GI: very low

Nutrient	DRI/DV
copper	21%
manganese	19%
vitamin C	13%
magnesium	11%
fiber	10%
phosphorus	10%
potassium	10%
folate	9%
vitamin B1	7%
vitamin K	7%
vitamin B6	7%
vitamin B3	6%
zinc	6%
omega-3 fats	6%
calcium	5%
pantothenic acid	5%
vitamin B2	5%
iron	4%
choline	3%

protein	3%

Health Benefits

As a general rule, summer squash has not been as thoroughly studied from a health benefit standpoint as many of the other World's Healthiest Foods. Much of the research evidence specific to summer squash and its health benefits comes from animal versus human studies, and these research studies often look at squash as an overall food group rather than examining specific benefits from summer (versus winter) squash. However, in spite of these research limitations, there are still well-documented health benefits that are offered to us by summer squash!

Antioxidant Benefits

No category of health benefits from summer squash is better researched than the category of antioxidant benefits. As an excellent source of manganese and a very good source of vitamin C. summer squash provides us with a great combination of conventional antioxidant nutrients. But it also contains an unusual amount of other antioxidant nutrients, including the carotenoids lutein and zeaxanthin. These antioxidants are especially helpful in antioxidant protection of the eye, including protection against age-related macular degeneration and cataracts. While we often think first about carrots as providing us with antioxidant-related eye health benefits, we also need to start including summer squash in our list of antioxidant-rich foods that can provide us with health benefits in this area.

If properly handled and prepared, summer squash also provides us with special antioxidant advantages in terms of its antioxidant stability. Recent research has confirmed strong retention of antioxidant activity in summer squash after steaming. Research has also confirmed excellent retention of antioxidant activity in summer squash after freezing. These findings mean that the antioxidant benefits of summer squash are available to us under a wide variety of circumstances. We have the option of enjoying raw summer squash, briefly steamed summer squash, and previously frozen summer squash while still coming away with well-documented antioxidant health benefits.

To obtain full antioxidant benefits from summer squash, we need to eat not only the flesh, but also the skin and the seeds. Many valuable antioxidant nutrients are found in those portions of the food, and studies document their importance in the overall antioxidant activity of summer squash. Purchasing organic summer squash is your best way to lower risk of potentially unwanted contaminants (like pesticides) on the skin of this vegetable. While purchasing organic, it's still worthwhile to use a natural bristle brush and gently cleanse the skin of the summer squash under cold running water.

Blood Sugar Benefits

The list of nutrients in summer squash related to healthy blood sugar regulation is a long one. Metabolism of sugar in the body requires ample presence of many B-complex vitamins, and most of these B-complex vitamins are found in valuable amounts in summer squash. Included here are the B-vitamins folate, B6, B1, B2, B3, and choline. Also important in blood sugar metabolism are the minerals zinc and magnesium, as well as omega-3 fatty acids, and all of these nutrients are provided by summer squash.

A mainstay of dietary protection from type 2 diabetes—as well as a key step in food support of diabetes problems—is optimal intake of fiber. Summer squash not only provides a very good amount of dietary fiber at 2.5 grams per cup, but it also provides polysaccharide fibers like pectin that have special benefits for blood sugar regulation. The pectin polysaccharides in summer squash often include chains of D-galacturonic acid called homogalacturonan. An increasing number of animal studies now show that these components in summer squash help keep insulin metabolism and blood sugar levels in balance, and protect against the onset of type 2 diabetes.

Anti-Inflammatory Benefits

While lacking extensive research documentation, there are several other areas of health benefits from summer squash that are definitely worth noting and that may eventually have strong scientific back-up. The first of these areas involves inflammation-related conditions. The presence of omega-3 fats in the seeds of summer squash, the presence of anti-inflammatory carotenoids like lutein, zeaxanthin and beta-carotene, and the presence of anti-inflammatory polysaccharides like homogalacturonan make this vegetable a natural choice for protection against unwanted inflammation. Several preliminary animal studies show potential anti-inflammatory protection from summer squash for the cardiovascular system and also for the GI tract. (Two special areas of digestive tract interest involve anti-inflammatory protection against gastric ulcer and duodenal ulcer.) Insofar as chronic, unwanted inflammation is also a risk factor for development of type 2 diabetes, the anti-inflammatory benefits of summer squash may play an important role in its protection against type 2 diabetes as well.

Antimicrobial Protection

The seeds of summer squash and oils extracted from its seeds have a long history of use in botanical and folk medicine in two areas. The first area involves the anti-microbial properties of summer squash seeds, and especially their anti-parasitic properties. Interestingly, dried summer squash seeds are still used in some parts of the world for treatment of intestinal tapeworms or other intestinal parasites. We have not seen peer-reviewed studies focusing on the antimicrobial benefits of summer squash seeds, but from our perspective, these benefits are unlikely to come from a food approach to summer squash that includes this vegetable in modest amounts as part of a healthy, whole foods diet. Far more likely these benefits will come from a medicinal approach to summer squash that involves consumption of its dried seeds in non-food amounts or extract of oils from those seeds.

Prostate Health Support

The second area of folk medicine use involves non-cancerous enlargement of the prostate gland known as benign prostatic hyperplasia, or BPH. Seeds of summer squash (and oils from those seeds) have traditionally been used to help lower frequency of urination that is commonly experienced in men diagnosed with BPH. Like the area of anti-microbial benefits, we have not seen peer-reviewed studies focusing on summer squash seeds and their potential benefits in lessening frequency of urination in BPH. But from our perspective, these benefits are also unlikely to come from a food approach to summer squash that includes this vegetable in modest amounts as part of a healthy, whole foods diet. Far more likely these benefits will come from a medicinal approach to summer squash that involves consumption of its dried seeds in non-food amounts or from seed oil extracts.

Anti-Cancer Benefits

The combination of antioxidant and anti-inflammatory nutrients in summer squash is a very logical nutrient combination for providing anti-cancer benefits. The development of many cancer types depends on chronic, unwanted oxidative stress that can occur along with poor intake of antioxidant nutrients, and chronic, unwanted inflammation that can occur along with lack of anti-inflammatory nutrients. While we eventually expect to see well-documented anti-cancer benefits from summer squash in large-scale human studies, the anti-cancer research on summer squash is still in a preliminary stage.

Description

Summer squashes belong to the *Cucurbitaceae* family of plants and are relatives of winter squashes (including pumpkins), melons (including watermelon), and even cucumbers. But summer squashes are typically much more delicate than their fellow *Cucurbitaceae*, and are more often eaten fresh and shortly after harvest. The list presented below will give you more details about the *Cucurbitaceae* food family and shows how exactly how summer squashes fit in.

- *Cucurbita* Genus
    - winter squashes
    - summer squashes
- *Cucumis* Genus
    - cucumbers
    - casaba melons
    - Crenshaw melons
    - honeydew melons
    - muskmelon
- *Citrullus* Genus
    - watermelons
    - bitter apple

In the United States, you'll generally find three types of summer squash:

- Zucchini, whose skin can be yellow in color but is much more often found in grocery stores showcasing its dark green skin. (The dark green skin of zucchini may also be naturally striped or speckled.) Zucchini is one of the summer squash types that grow on flowering plants with edible flowers. Black beauty, cocozelle, golden, courgette, and dark green are some of the popular varieties of zucchini.
- Crookneck and straightneck squashes, usually yellow in color. While sometimes available with light green skins, bright yellow crookneck and straightneck squashes are the varieties that we most commonly associate with summer squash. (We've become especially accustomed to seeing small, bulb-shaped, bright yellow crookneck squashes in the United

States.) Crookneck and straightneck summer squashes can be very similar in appearance, since crookneck varieties may have a very minimally curved neck that is almost swan-like in appearance. Golden summer, yellow crookneck, and early straightneck are some popular varieties of crookneck and straightneck squashes. Cushaw squashes are special varieties of crookneck squashes that are much larger than other crooknecks, even though they are easily recognized by their similar bulb-like shape. Cushaws take about twice as long to grow as other crooknecks, and are often used in baking (for example, in pies).

- Scallop squashes, also called pattypan squashes. These summer squashes are typically saucer-shaped and come in a wide variety of colors from very pale yellow to golden yellow to medium green. Scallop squashes sometimes have a slightly sweeter flesh than other summer squashes. Popular varieties include green tint scallop, scallop early white bush, scallop yellow bush, and sunburst. In some countries, you'll also hear the words "scallopini" or "button squash" used to describe the scallop squashes.

For readers interested in the scientific classification of these amazing summer squashes, we've provided a list below that shows basic types of summer and winter squashes and their botanical genus and species:

***Cucurbita* Genus and Species of Foods (including Summer Squash varieties)**

- *Cucurbita pepo* (variety melopepo)
  - zucchini (summer variety)
  - yellow crookneck squash (summer variety)
  - scallop squash (summer variety)
- *Cucurbita pepo* (variety pepo)
  - acorn squash (winter variety)
  - delicata squash (winter variety)
  - spaghetti squash (winter variety)
- *Cucurbita maxima*
  - buttercup squash (winter variety)
  - Hubbard squash (winter variety)
  - banana squash (winter variety)
  - Boston Marrow squash (winter variety)
  - Turkish turban (winter variety)
- *Cucurbita moschata*
  - butternut squash (winter variety)
  - winter crookneck squash
- *Cucurbita argyosperma**
  - cushaw squash (summer variety)

*This genus/species can also be referred to as *Cucurbita mixta*.

History

Amazingly, scientists have found squash seeds (from the genus-species *Cucurbita pepo*, which includes summer squash) preserved in Mexican caves for more than 10,000 years! It was that long ago when domestication of summer squash originated in Mexico and Central America. Cultivation of squashes (including summer squash) quickly became popular in North, Central, and South America, and Native Americans often referred to squashes as one of the "three sisters" alongside of corn (maize) and beans. Squashes were one of the North American foods that Columbus brought back to Spain from North America, and Portuguese and Spanish explorers introduced squashes to many parts of the world.

Commercial production of squash (including summer squash) now takes place on a worldwide basis, and the largest producers of squash including the United States, China, India, and Russia. The Pacific Islands region—including Papua New Guinea, Tonga, French Polynesia, Fiji, Hawaii, and New Zealand—is also an important area for squash production. Total global production of squash measures more than 5 billion metric tons, with over 500,000 acres planted. Florida, California, Georgia and New York are the top squash-growing states in the U.S., producing more than 650 million pounds of squash. The U.S. is also the world's largest importer of squash, importing nearly 300,000 metric tons per year. (Ninety-five percent of U.S. imported squash comes from Mexico.)

How to Select and Store

When purchasing summer squash, look for ones that are heavy for their size and have shiny, unblemished rinds. Additionally, the rinds should not be very hard since this indicates that the squash are over-mature and will have hard seeds and stringy flesh.

Purchase summer squash that are of average size since those that are overly large may be fibrous, while those that are overly small may be inferior in flavor.

Summer squash is very fragile and should be handled with care as small punctures will lead to decay. It should be stored unwashed in an air-tight container in the refrigerator, where it will keep for about seven days.

While it can be frozen, this will make the flesh much softer. We don't recommend freezing as a routine storage method. Yet, it is a great process to turn to if you have amounts larger than you will be able to consume (for example, if you grow summer squash in your garden and have a bounty of it). The fact is that the freezing of summer squash can be an excellent storage process in terms of nourishment. A recent research study has shown excellent retention of the antioxidant activity in frozen summer squash.

Begin by slicing your summer squash and steaming for three minutes. Steaming is prefereable to the more traditional boiling method as it minimizes water contact and therefore minimizes nutrient loss. Remove squash from steamer and let cool thoroughly before placing in freezer bags and storing in the freezer.

How to Enjoy

A Few Quick Serving Ideas

- Sprinkle grated zucchini or other summer squash on top of salads and sandwiches.
- Enjoy an easy to make ratatouille by healthy sautéing summer squash, onions, bell peppers, eggplant and tomatoes and then simmering the mixture in tomato sauce. Season to taste.
- Serve raw summer squash with your favorite dips.

WHFoods Recipes That Feature Summer Squash

- Any Time Frittata
- Italian Tofu Frittata
- Zesty Mexican Soup
- Southwestern Cod Saute
- Primavera Verde
- 5-Minute Healthy Sauteed Summer Squash
- Calabacitas (Mexican-flavored vegetable side dish)
- Steamed Vegetable Medley
- Tahini and Crudites Appetizer

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Summer Squash, sliced, cooked
1.00 cup
180.00 grams

Calories: 36
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
copper	0.19 mg	21	10.6	excellent
manganese	0.38 mg	19	9.5	excellent

vitamin C	9.90 mg	13	6.6	very good
magnesium	43.20 mg	11	5.4	very good
fiber	2.52 g	10	5.0	very good
phosphorus	70.20 mg	10	5.0	very good
potassium	345.60 mg	10	4.9	very good
folate	36.00 mcg	9	4.5	very good
vitamin B6	0.12 mg	7	3.5	very good
vitamin K	6.30 mcg	7	3.5	very good
vitamin B1	0.08 mg	7	3.3	good
zinc	0.70 mg	6	3.2	good
omega-3 fats	0.15 g	6	3.1	good
vitamin B3	0.92 mg	6	2.9	good
vitamin B2	0.07 mg	5	2.7	good
pantothenic acid	0.25 mg	5	2.5	good
calcium	48.60 mg	5	2.4	good
iron	0.65 mg	4	1.8	good
choline	14.22 mg	3	1.7	good
protein	1.64 g	3	1.6	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Squash, winter

What's New and Beneficial about Winter Squash

- Although winter squash has long been recognized as an important food source of carotenoids, only recently have research studies documented just how fantastic winter squash can be when it comes to these key antioxidants. For some groups of study participants, winter squash turns out to be the primary food source of alpha-carotene and beta-carotene in the entire diet! For lutein, zeaxanthin, and beta-cryptoxanthin (three other health-supportive carotenoids) winter squash also comes out among the top three food sources in several studies.
- Seeds from winter squash make a great snack food, just like pumpkin seeds. If you scoop the pulp and seeds from inside the squash and separate out the seeds, you can place them in a single layer on a cookie sheet and lightly roast them at 160-170°F (about 75°C) in the oven for 15-20 minutes. By roasting them for a relatively short time at a low temperature you can help minimize damage to their healthy oils. Linoleic acid (the polyunsaturated omega-6 fatty acid) and oleic acid (the same monounsaturated fatty acid that is plentiful in olive oil) account for about 75% of the fat found in the seeds.
- We think about winter squash as a very starchy vegetable—about 90% of its total calories come from carbohydrate, and about half of this carbohydrate is starch-like in its composition. However, recent research has made it clear that all starch is not the same, and the starch content of winter squash brings along with it some key health benefits. Many of the carbs in winter starch come from polysaccharides found in the cell walls. These polysaccharides include pectins—specially structured polysaccharides that in winter squash often include special chains of D-galacturonic acid called homogalacturonan. An increasing number of animal studies now show that these starch-related components in winter squash have antioxidant, anti-inflammatory, as well as anti-diabetic and insulin-regulating properties.
- Winter squash is a vegetable that might be especially important for us to purchase organic. Recent agricultural trials have shown that winter squash can be an effective intercrop for use in remediation of contaminated soils. Polycyclic aromatic hydrocarbons (PAHs), including pyrene, fluoranthene, chrysene, benzo(a)anthracene and benzo(a)pyrene are unwanted contaminants. PAHs are among the contaminants that can be effectively pulled up out of the soil by winter squash plants. When winter squash is planted as a food crop (as opposed to a non-food crop that is being planted between food crop seasons to help improve soil quality), the farmer's goal is definitely not to transfer soil contaminants like PAHs up into the food. But some of that transfer seems likely to happen, given the effectiveness of winter squash in mobilizing contaminants like PAHs from the soil. For this reason, you may want to make a special point of purchasing certified organic winter squash. Soils used for the growing of in certified organic foods are far less likely to contain undesirable levels of contaminants like PAHs.

WHFoods Recommendations

Our favorite way to prepare winter squash is to steam it as it takes such a short period of time. It's best to steam 1-inch cubes of squash. The preparation for this is described in the How to Enjoy section below. For most types of squash you only need to steam it for 7 minutes. So you save time and enjoy a host of more nutrients.

Winter Squash, cubed, cooked
1.00 cup
(205.00 grams)

Calories: 76
GI: low

Nutrient	DRI/DV
vitamin A	59%
vitamin C	26%
fiber	23%
vitamin B6	19%
manganese	19%
copper	19%
potassium	14%
vitamin B2	11%
pantothenic acid	10%
folate	10%
vitamin K	10%
omega-3 fats	8%
magnesium	7%
vitamin B3	6%

Health Benefits

Antioxidant Support

While we've become accustomed to thinking about leafy vegetables as an outstanding source of antioxidants, we've been slower to recognize the outstanding antioxidant benefits provided by other vegetables like winter squash. But we need to catch up with the times! Recent research has made it clear just how important winter squash is worldwide to antioxidant intake, especially so in the case of carotenoid antioxidants. From South America to Africa to India and Asia and even in some parts of the United States, no single food provides a greater percentage of certain carotenoids than winter squash. (In the United States, a recent study that has determined winter squash to be the number one source of alpha-carotene and beta-carotene among Hispanic men ages 60 and older living within the state off Massachusetts. And we've seen studies ranking foods from this *Cucurbita* genus at the top of the carotenoid list in Cameroon, Sri Lanka, and the West Indies!)

The unique carotenoid content of the winter squashes is not their only claim to fame in the antioxidant department, however. There is a very good amount of vitamin C in winter squash (about one-third of the Daily Value in every cup) and a very good amount of the antioxidant mineral manganese as well. Recent research has shown that the cell wall polysaccharides found in winter squash also possess antioxidant properties, as do some of their phenolic phytonutrients.

Anti-Inflammatory Benefits

Most of the research to date on winter squash and inflammation has either been conducted using laboratory animals, or has been focused on laboratory studies of cell activity. Still, results in this area have been fascinating and also promising with respect to winter squash as an anti-inflammatory food. In some of the more detailed studies, specific inflammation-related molecules, enzymes, or cell receptors (for example, nuclear factor kappa-B, nitric oxide synthase, or cyclo-oxygenase) have been studied as targets for the activity of the cucurbitacin molecules found in winter squash. Cucurbitacins are glycoside molecules found in a wide variety of foods, including the brassica vegetables, some mushrooms, and even some ocean mollusks. But they are named for the gourd-squash-melon family of foods (*Cucurbitaceae*) due to their initial discovery in this food family. Cucurbitacins can be extremely bitter tasting to animals as well as humans, and they are considered to be part of the plants' natural defense mechanisms. Yet the same properties that make cucurbitacins potentially toxic to some animals and microorganisms also make them effective as anti-viral, anti-bacterial, and anti-inflammatory substances when we consume them in winter squash.

While winter squash should not be treated as a high-fat food, it does contain fats, including the anti-inflammatory omega-3s. One cup of baked winter squash will provide you with approximately 340 milligrams of omega-3 fats in the form of alpha-linolenic acid (ALA). While that amount is only about one-third as high as the concentration of ALA found in the "best of the best" omega-3 plant foods like walnuts, it is still a valuable amount being provided by a low-fat food. (Less than 15% of the calories in winter squash come from fat, compared with almost 90% of the calories in walnuts!). With winter squash, we have a fantastic anti-inflammatory food opportunity in which we can get a valuable amount of our anti-inflammatory omega-3s without much of a change in our total fat intake.

Promotes Optimal Health

It's the combination of antioxidant and anti-inflammatory compounds in winter squash that have shown this food to have clear potential in the area of cancer prevention and cancer treatment. Prostate cancer is the cancer type that has been of greatest research interest in this regard, followed by colon cancer, breast cancer, and lung cancer. We have yet to see cancer-related studies that involve everyday amounts of winter squash consumed in food form. Most of the studies in this area have involved extracts from foods in the *Cucurbita* genus, or isolated, purified substances (like cucurbitans) that can be obtained from those foods. Still, given the clear antioxidant and anti-inflammatory benefits of winter squash, we expect to see cancer studies in humans eventually identifying this food as a risk reducer for certain cancer types.

Potential Blood Sugar Regulation Benefits

A second area of high potential for winter squash and its health benefits is blood sugar regulation and prevention of type 2 diabetes. We've already seen evidence in animal studies that show improvement in blood sugar and insulin regulation following intake of cell wall polysaccharides from winter squash and other *Cucurbita* foods. Likewise, we've seen research pointing to other nutrients found in winter squash as beneficial for blood sugar control. These nutrients include the B-vitamin like compound d-chiro-inositol—a nutrient we expect to see moving up on the radar screen with respect to blood sugar regulation. It's also important to remember that blood sugar regulation is closely tied to our overall supply of B-complex vitamins, and that winter squash is unusual in its B-vitamin composition. This food provides a good amount of five B-complex vitamins! Those vitamins are B1, B3, B6, pantothenic acid, and folate.

Other Health Benefits

Finally, we believe that future research may underscore the health benefits provided by winter squash for prevention of cardiovascular disease. We already know that this food provides key antioxidant and anti-inflammatory benefits—two categories of nutrient support critically needed for reduced risk of most cardiovascular problems. But we also have preliminary evidence to suggest that there may be unique substances in the *Cucurbita* vegetables that partially block the formation of cholesterol in our cells by inhibiting an enzyme called HMG-CoA reductase. Coupled with its unique antioxidant and anti-inflammatory composition, winter squash may turn out to be particularly important food for inclusion in a heart healthy diet.

Description

Winter squash, members of the *Cucurbitaceae* family and relatives of both the melon and the cucumber, come in many different varieties. While each type varies in shape, color, size and flavor, they all share some common characteristics. Their shells are hard and difficult to pierce, enabling them to have long storage periods between one week and six months. Their flesh is mildly sweet in flavor and finely grained in texture. Additionally, all have seed-containing hollow inner cavities.

We are just beginning to discover the wealth of nourishment supplied by the mildly sweet flavored and finely textured winter squash, a vegetable that was once such an important part of the diet of the Native Americans that they buried it along with the dead to provide them nourishment on their final journey. Winter squash is available from August through March; however, they are at their best from October to November when they are in season.

The list presented below will give you more details about the fascinating food family of Cucurbitaceae. Here you can see the foods that are relatives of winter squash:

Cucurbitaceae Food Family

Cucurbita Genus

- winter squashes
- summer squashes

Cucumis Genus

- cucumbers
- casaba melons
- Crenshaw melons
- honeydew melons
- muskmelon

Citrullus Genus

- watermelon
- bitter apple

As noted in the lists above, both winter squashes and summer squashes can be found within the *Cucurbita* genus of this food family. Here are some key food species—including varieties of winter squash—that you'll find in this amazing Cucurbita genus of foods: *Cucurbita* Genus and Species of Foods (including Winter Squash varieties)

Cucurbita pepo* (variety melopepo)	Cucurbita pepo (variety pepo)	Cucurbita maxima	Cucurbita moschata	Cucurbita argyosperma*
zucchini (summer variety)	acorn squash (winter variety)	buttercup squash (winter variety)	butternut squash (winter variety)	cushaw squash (summer variety)
yellow crooknook squash (summer variety)	delicata squash (winter variety)	Hubbard squash (winter variety)	winter crookneck squash	cushaw squash
scallop squash (summer variety)	spaghetti squash (winter variety)	banana squash (winter variety)		

		Boston marrow squash (winter variety)		
		Turk's turban squash (winter variety)		

As presented in the chart above, common varieties of winter squash include:

- Butternut squash: Shaped like a large pear, this squash has cream-colored skin, deep orange-colored flesh and a sweet flavor.
- Acorn squash: With harvest green skin speckled with orange patches and pale yellow-orange flesh, this squash has a unique flavor that is a combination of sweet, nutty and peppery.
- Hubbard squash: A larger-sized squash that can be dark green, grey-blue or orange-red in color. The Hubbard's flavor is less sweet than many other varieties.
- Turban squash: Green in color and either speckled or striped, this winter squash has an orange-yellow flesh whose taste is reminiscent of hazelnuts.
- Kabocha squash: A type of Japanese squash that is becoming more and more popular in the U.S., kabocha squash is very sweet in flavor. It has deep green skin and orange flesh.

Pumpkins are also members of the *Cucurbitaceae* food family, and also within the *Cucurbita* genus of these amazing foods. However, the word "pumpkin" can be confusing and it is used in different countries in different ways. In Australia, for example, the word "pumpkin" is often used to refer to the same category of foods that are called "winter squashes" in the United States. Since there are literally hundreds of pumpkin varieties grown worldwide, and since there are pumpkin varieties that can be found within each of the *Cucurbita* species presented in the chart above, pumpkins can be confusing from a botanical standpoint. Additionally, they are not always easy to categorize within a "summer versus winter" classification system (even though they are generally a warm weather crop). Pumpkins are not the least bit confusing, however, from a taste and texture standpoint! These delicious foods can be amazingly sweet tasting (as is the case with sugar pumpkin, also sometimes called pie pumpkin), and they are among the most versatile members of this entire gourd-squash-melon food family.

History

Modern day squash developed from the wild squash that originated in an area between Guatemala and Mexico. While squash has been consumed for over 10,000 years, they were first cultivated specifically for their seeds since earlier squash did not contain much flesh, and what they did contain was very bitter and unpalatable. As time progressed, squash cultivation spread throughout the Americas, and varieties with a greater quantity of sweeter-tasting flesh were developed. Christopher Columbus brought squash back to Europe from the New World, and like many other native American foods, their cultivation was introduced throughout the world by Portuguese and Spanish explorers. Today, the largest commercial producers of squash include China, Japan, Romania, Turkey, Italy, Egypt, and Argentina.

How to Select and Store

Winter squash is easily prone to decay, so it is important to carefully inspect it before purchase. Choose ones that are firm, heavy for their size and have dull, not glossy, rinds. The rind should be hard as soft rinds may indicate that the squash is watery and lacking in flavor. Avoid those with any signs of decay, which manifest as areas that are water-soaked or moldy.

Winter squash has a much longer storage life than summer squash. Depending upon the variety, it can be kept for between one week to six months. It should be kept away from direct exposure to light and should not be subject to extreme heat or extreme cold. The ideal temperature for storing winter squash is between 50-60°F (about 10-15°C). Once it is cut, cover the pieces of winter squash in plastic wrap and store them in the refrigerator, where they will keep for one or two days. The best way to freeze winter squash is to first cut it into pieces of suitable size for individual recipes.

How to Enjoy

A Few Quick Serving Ideas

- Top puréed cooked winter squash with cinnamon and maple syrup.
- Steam cubes of winter squash and then dress with olive oil, soy sauce, ginger and pumpkin seeds.
- Top "strings" of spaghetti squash with pasta sauce.

- Add cubes of winter squash to your favorite vegetable soup recipe.

WHFoods Recipes That Feature Winter Squash

- 7-Minute Butternut Squash
- Braised Red Curry Lamb & Vegetables
- Golden Squash Soup
- Steamed Butternut Squash with Almond Sauce
- Steamed Butternut Squash with Red Chili Sauce

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Winter Squash, cubed, cooked
1.00 cup
205.00 grams
Calories: 76
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin A	535.36 mcg RAE	59	14.1	excellent
vitamin C	19.68 mg	26	6.2	very good
fiber	5.74 g	23	5.4	very good
vitamin B6	0.33 mg	19	4.6	very good
manganese	0.38 mg	19	4.5	very good
copper	0.17 mg	19	4.5	very good
potassium	494.05 mg	14	3.3	good
vitamin B2	0.14 mg	11	2.6	good
folate	41.00 mcg	10	2.4	good
vitamin K	9.02 mcg	10	2.4	good
pantothenic acid	0.48 mg	10	2.3	good
omega-3 fats	0.19 g	8	1.9	good
magnesium	26.65 mg	7	1.6	good
vitamin B3	1.01 mg	6	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Sweet potatoes

What's New and Beneficial about Sweet Potatoes

- Orange-fleshed sweet potatoes may be one of nature's unsurpassed sources of beta-carotene. Several recent studies have shown the superior ability of sweet potatoes to raise our blood levels of vitamin A. This benefit may be particularly true for children. In several studies from Africa, sweet potatoes were found to contain between 100-1,600 micrograms (RAE) of vitamin A in every 3.5 ounces—enough, on average, to meet 35% of all vitamin A needs, and in many cases enough to meet over 90% of vitamin A needs (from this single food alone).
- Sweet potatoes are not always orange-fleshed on the inside but can also be a spectacular purple color. Sometimes it's impossible to tell from the skin of sweet potato just how rich in purple tones its inside will be. That's because scientists have now identified the exact genes in sweet potatoes (*IbMYB1* and *IbMYB2*) that get activated to produce the purple anthocyanin pigments responsible for the rich purple tones of the flesh. The purple-fleshed sweet potato anthocyanins—primarily peonidins and cyanidins—have important antioxidant properties and anti-inflammatory properties. Particularly when passing through our digestive tract, they may be able to lower the potential health risk posed by heavy metals and oxygen radicals. For more details on purple-fleshed and orange-fleshed sweet potatoes, please see our Description section below.
- It can be helpful to include some fat in your sweet potato-containing meals if you want to enjoy the full beta-carotene benefits of this root vegetable. Recent research has shown that a minimum of 3-5 grams of fat per meal significantly increases our uptake of beta-carotene from sweet potatoes. Of course, this minimal amount of fat can be very easy to include. In our Healthy Mashed Sweet Potatoes recipe, for example, we include 1 tablespoon of extra virgin olive oil, and with just this one tablespoon, each of our 4 servings for this delicious recipe provides 3.5 grams of fat.
- Some nutritional benefits from sweet potatoes simply may be easier to achieve if you use steaming or boiling as your cooking method. Recent studies show excellent preservation of sweet potato anthocyanins with steaming, and several studies comparing boiling to roasting have shown better blood sugar effects (including the achievement of a lower glycemic index, or GI value) with boiling. The impact of steaming is particularly interesting, since only two minutes of steaming have been show to deactivate peroxidase enzymes that might otherwise be able to break down anthocyanins found in the sweet potato. In fact, with these peroxidase enzymes deactivated, natural anthocyanin extracts from sweet potato used for food coloring may be even more stable than synthetic food colorings. This benefit isn't limited to the food's appearance since the anthocyanins have great health benefits as antioxidants and anti-inflammatory nutrients.
- Most dry beans and tubers have their own unique storage proteins. Soybeans have glycinins, potatoes have patatins, yams have dioscorins, and corn has zeins. While researchers have long been aware of sporamins—storage proteins in sweet potato—only recently has research shown some of their unique antioxidant properties. The potential health benefits of the sweet potato sporamins in helping prevent oxidative damage to our cells should not be surprising since sweet potatoes produce sporamins whenever subjected to physical damage to help promote healing.

WHFoods Recommendations

Sweet potatoes don't have to take a long time to prepare. Cutting them into 1/2-inch slices and Healthy Steaming them for just 7 minutes not only brings out their great flavor but helps to maximize their nutritional value. And you can add cinnamon, nutmeg, and/or cloves for extra flavor and nutrition. For more on The Healthiest Way of Cooking Sweet Potatoes see the How to Enjoy section below.

Sweet Potato, baked
1.00 cup
(200.00 grams)

Calories: 180
GI: medium

Nutrient	DRI/DV
vitamin A	214%
vitamin C	52%
manganese	50%
copper	36%
pantothenic acid	35%
vitamin B6	34%
biotin	29%
potassium	27%
fiber	26%
vitamin B3	19%

vitamin B1	18%
vitamin B2	16%
phosphorus	15%

Health Benefits

How sweet it is for your health to eat sweet potatoes! Not only do they taste like dessert, but they provide some surprising health benefits. Many people think about sweet potatoes as being nothing more than plain old potatoes that can tweak our taste buds with some extra flavor. Yet cutting-edge research on sweet potatoes tells us that nothing could be further from the truth as they have so many unique nutritional benefits to offer!

One difficulty in describing the health benefits of sweet potatoes is knowing where to begin. There are a surprising number of nutrient categories responsible for the health benefits of this underappreciated tuber. Among these categories are antioxidants, anti-inflammatory nutrients, and blood sugar-regulating nutrients. Each category brings with it valuable health benefits.

Antioxidant Nutrients in Sweet Potato

Sweet potatoes contain a wealth of orange-hued carotenoid pigments. In countries throughout Africa, in India and in the Caribbean, sweet potatoes have been shown to be a highly effective way of providing school age children with sizable amounts of their daily vitamin A. In some studies, sweet potatoes have been shown to be a better source of bioavailable beta-carotene than green leafy vegetables. Because sweet potatoes are available in many countries on a virtual year-round basis, their ability to provide us with a key antioxidant like beta-carotene makes them a standout antioxidant food.

Yet beta-carotene only begins to tell the story of sweet potato antioxidants. Particularly in purple-fleshed sweet potato, antioxidant anthocyanin pigments are abundant. Cyanidins and peonidins are concentrated in the starchy core of part of purple-fleshed sweet potatoes, and these antioxidant nutrients may be even more concentrated in the flesh than in the skin. That's sweet potatoes have genes (*IbMYB1* and *IbMYB2*) that are specialized for the production of anthocyanin pigments in the fleshy part of the tuber. Ordinary, we have to rely on the skins of foods for this same level of anthocyanin antioxidants. But not in the case of sweet potatoes! Extracts from the highly pigmented and colorful purple-fleshed and purple-skinned sweet potatoes have been shown in research studies to increased the activity of two key antioxidant enzymes—copper/zinc superoxide dismutase (Cu/Zn-SOD) and catalase (CAT).

Recent research has shown that particularly when passing through our digestive tract, sweet potato cyanidins and peonidins and other color-related phytonutrients may be able to lower the potential health risk posed by heavy metals and oxygen radicals. That risk reduction might be important not only for individuals at risk of digestive tract problems but for all persons wanting to reduce the potential risk posed by the presence of heavy metal residues (like small amounts of mercury or cadmium or arsenic) in their diet.

Storage proteins in sweet potato also have important antioxidant properties. These storage proteins—called sporamins—get produced by sweet potato plants whenever the plants are subjected to physical damage. Their ability to help the plants heal from this damage is significantly related to their role as antioxidants. Especially when sweet potato is being digested inside of our gastrointestinal tract, we may get some of these same antioxidant benefits.

Anti-Inflammatory Nutrients in Sweet Potato

Anthocyanin and other color-related pigments in sweet potato are equally valuable for their anti-inflammatory health benefits. In the case of inflammation, scientists understand even more about the amazing properties of this tuber. In animal studies, activation of nuclear factor-kappa B (NF-kB); activation of inducible nitric oxide synthase (iNOS), and cyclooxygenase-2 (COX-2); and formation of malondialdehyde (MDA) have all be shown to get reduced following consumption of either sweet potato or its color-containing extracts. Since each of these events can play a key role in the development of unwanted inflammation, their reduction by sweet potato phytonutrients marks a clear role for this food in inflammation-related health problems. In animal studies, reduced inflammation following sweet potato consumption has been shown in brain tissue and nerve tissue throughout the body.

What's equally fascinating about color-related sweet potato phytonutrients is their impact on fibrinogen. Fibrinogen is one of the key glycoproteins in the body that is required for successful blood clotting. With the help of a coagulation factor called thrombin, fibronogen gets converted into fibrin during the blood clotting process. Balanced amounts of fibrinogen, thrombin and fibrin are a key part of the body's health and its ability to close off wounds and stop loss of blood. However, excess amounts of these clotting-related molecules may sometimes pose a health risk. For example, excess presence of fibrinogen and fibrin can trigger unwanted secretion of pro-inflammatory molecules (including cytokines and chemokines). In animal studies, too much fibrin in the central nervous system has been associated with breakdown of the myelin sheath that surrounds the nerves and allows them to conduct electrical signals properly. If fibrin excess can trigger unwanted inflammation in nerve tissue and increase breakdown of the myelin wrapping the nerve cells (a process that is usually referred to as demyelination), health problems like multiple sclerosis (in which there is breakdown of the myelin nerve sheath) may be lessened through reduction of excess fibrinogen and/or fibrin. In preliminary animal studies, intake of sweet potato color extracts have been shown to accomplish exactly those results: reduction of inflammation, and simultaneous reduction of fibronogen levels. We look forward to exciting new research in this area of sweet potato's anti-inflammatory benefits.

Potential Improvement of Blood Sugar Regulation

Many people think about starchy root vegetables as a food group that could not possibly be helpful for controlling their blood sugar. That's because many people realize that food starches can be converted by our digestive tract into simple sugars. If foods are especially concentrated in starch, there can often be a risk of too much simple sugar release in our digestive tract and too much pressure upon our bloodstream to uptake more sugar. (The result in this situation would be an overly quick elevation of our blood sugar level.) What's fascinating about sweet potatoes is their ability to potentially *improve* blood sugar regulation— even in persons with type 2 diabetes— in spite of their glycemic index (GI) rating of medium. (Sweet potatoes are one of four WHFoods vegetables that have a GI ranking of medium. The other three vegetables are beets, corn, and leeks.) The 6.6 grams of dietary fiber in a medium sweet potato are definitely a plus in terms of blood sugar regulation, since they help steady the pace of digestion. But recent research has also shown that extracts from sweet potatoes can significantly increase blood levels of adiponectin in persons with type 2 diabetes. Adiponectin is a protein hormone produced by our fat cells, and it serves as an important modifier of insulin metabolism. Persons with poorly-regulated insulin metabolism and insulin insensitivity tend to have lower levels of adiponectin, and persons with healthier insulin metabolism tend to have higher levels. While more research on much larger groups of individuals to further evaluate and confirm these blood sugar regulating benefits, this area of health research is an especially exciting one for anyone who loves sweet potatoes but is nevertheless concerned about healthy blood sugar regulation.

Other Potential Health Benefits

One of the more intriguing nutrient groups provided by sweet potatoes—yet one of the least studied from a health standpoint— are the resin glycosides. These nutrients are sugar-related and starch-related molecules that are unusual in their arrangement of carbohydrate-related components, and also in their inclusion of some non-carbohydrate molecules. In sweet potatoes, researchers have long been aware of one group of resin glycosides called batatins (including batatin I and batatin II). But only recently have researchers discovered a related group of glycosides in sweet potato called batatosides (including batatodide III, batatoside IV, and batatoside V). In lab studies, most of these sweet potato glycosides have been shown to have antibacterial and antifungal properties. To what extent these carbohydrate-related molecules in sweet potatoes can provide us with health benefits in these same antibacterial and antifungal areas is not yet clear. But we expect to see increasing interest in sweet potato's batatins and batatosides and their potential to support our health.

Description

Although sweet potatoes may be part of the Thanksgiving tradition, be sure to add these wonderful naturally sweet vegetables to your meals throughout the year; they are some of the most nutritious vegetables around. Sweet potatoes can be found in your local markets year-round, however they are in season in November and December.

While many people lump all potatoes into one category, potatoes can actually be quite different in terms of their taste, flavor, texture, and nutrients. Sweet potatoes are no exception! Sweet potatoes belong to an entirely different food family than either yams or the common potato that is such a large part of the U.S. diet. From a science standpoint, here's a chart showing how different these three types of potatoes actually are.

Type of Potato	Botanical Family	Botanical Genus	Botanical Species
Common U.S. Potato	*Solanaceae*	*Solanum*	*S. tuberosum*
Sweet Potato	*Convolvulaceae*	*Ipomoea*	*I. batatas*
Yam	*Dioscoreaceae*	*Dioscorea*	*D. alata**

* Worldwide, there are nearly 200 commonly eaten species of yam.

In some food families all foods belong not only to the same botanical family and genus but sometimes to the same species as well! For example, both Swiss chard and beets belong to the same botanical family and genus and species. When foods belong to the same family and genus, they are more likely to share commonality in their nutrient composition and health benefits. From this standpoint, potatoes are far more diverse, and when you choose sweet potatoes as a dietary root vegetable, you are getting a truly unique type of potato that is nutritionally different from other types.

Depending upon the variety, of which there are about 400, the skin and flesh of the sweet potato may be almost white, cream, yellow, orange, pink, or deep purple, although white/cream and yellow-orange flesh are most common. Sometimes this root vegetable will be shaped like a potato, being short and blocky with rounded ends, while other times it will be longer with tapered ends.

There are common names for most cultivars of sweet potatoes, and you may find the chart below helpful in selecting a sweet potato with the flesh color you desire based on the cultivar name.

Orange-fleshed*	**Purple-fleshed**	**White-fleshed**
Beuregarde	Agena	Batas
California Gold	Japanese Purple	Brazilian
Carolina Ruby	Korean Purple	Dingess
Covington	Mokuau	Hayman
Evangeline	Okinawan	O'Henry
Gold Nugget	Purple	Uyentan

*Most sweet potato cultivars that contain the word "gold" or the word "red" in their title are orange-fleshed varieties.

The intensity of the sweet potato's yellow or orange flesh color is directly correlated to its beta-carotene content. Our bodies can typically produce vitamin A from the beta-carotene in orange-fleshed sweet potato; this is why this nutrient is often referred to as "Provitamin A."

Purple-fleshed sweet potatoes, on the other hand, are a fantastic source of anthocyanins (especially peonidins and cyanidins) and have outstanding antioxidant activity. In one study, the antioxidant activity in purple sweet potatoes was 3.2 times higher than that of a type of blueberry! An equally amazing fact about sweet potatoes is the antioxidant capacity of all their parts. Recent research has shown different genes to be at work in the flesh versus skin of the sweet potato producing different concentrations of anthocyanin antioxidants. Even the leaves of the sweet potato plant have been shown to provide important antioxidant benefits and are included in soups in many cuisines. Sweet potatoes can be grouped into two different categories depending upon the texture they have when cooked: some are firm, dry, and mealy, while others are soft and moist. In both types, the taste is starchy and sweet with different varieties having different unique tastes.

Sweet Potatoes and Yams

In the U.S., there is often much confusion between sweet potatoes and yams. They are completely different foods, belonging to different plant families. Sweet potatoes are much more highly available in the U.S. than are yams.

This confusion exists for two reasons. First, as a shopper, it is possible for you to find sweet potatoes and yams that look reasonably alike in terms of size, skin color, and flesh color. Second, government agencies have allowed these terms to be used somewhat interchangeably on labeling, so that you often cannot rely on the grocery store signs to help you determine whether you are looking at a bin full of sweet potatoes or a bin full of yams. For example, in many stores you can find bins that are labeled "Red Garnet Yams" and "Jewel Yams" and the foods in these bins are actually sweet potatoes. Here are some general practical rules that you can follow.

- **In most U.S. groceries, you should assume that you are always purchasing a sweet potato, even if the sign says "yams."**Over 1 million sweet potatoes are commercially grown in the U.S. each year, while commercial production of yams in the U.S. is rare.
- Don't use flesh color to decide whether you are getting a sweet potato or a yam. Both root vegetables come in a variety of colors. **Once again, you should assume that you are getting a sweet potato regardless of flesh color.**
- If you are specially seeking a true yam (from the plant genus *Dioscorea*), it might be helpful to visit a more internationally focused store that specializes in foods from tropical countries.

Here is a little more background about the relationship between sweet potatoes and yams.

The name "yam" was adopted from "*nyami*"—the Fulani (West African) word that means "to eat" and that has traditionally been used to refer to yams. Yams are native to Africa and Asia, and unlike potatoes, they have the potential to grow to a much larger size.

From a science perspective, true yam is a root vegetable belonging to the *Dioscoreaceae* family, which are monocotyledons (or "monocots" for short, with the prefix "mono" referring to the fact that they have only one embryonic seed leaf). Sweet potatoes belong to the *Convolvulaceae* or morning glory plant family, are dicotyledons (or "dicots" for short, with the prefix "di" referring to the fact that they have two embryonic seed leaves), and are known by the scientific name of *Ipomoea batatas*. So as you can see, these two root vegetables come from very different parts of the plant world, even though their names have become so intertwined in the U.S. marketplace.

History

Sweet potatoes are native to Central and South America and are one of the oldest vegetables known to man. They have been consumed since prehistoric times as evidenced by sweet potato relics dating back 10,000 years that have been discovered in Peruvian caves.

Christopher Columbus brought sweet potatoes to Europe after his first voyage to the New World in 1492. By the 16th century, they were brought to the Philippines by Spanish explorers and to Africa, India, Indonesia and southern Asia by the Portuguese. Around this same time, sweet potatoes began to be cultivated in the southern United States, where they still remain a staple food in the traditional cuisine.

Worldwide, about 80 million tons of sweet potatoes are grown in China each year, with Africa producing about 14 million tons, Central and South America about 2 million, and the U.S. about 1 million tons. Within the U.S., over half of all commercially grown sweet potatoes come from the southern states (especially North Carolina).

How to Select and Store

Choose sweet potatoes that are firm and do not have any cracks, bruises or soft spots. Avoid those that are displayed in the refrigerated section of the produce department since cold temperature negatively alters their taste.

Sweet potatoes should be stored in a cool, dark and well-ventilated place, where they will keep fresh for up to ten days. Ideally, they should be kept out of the refrigerator in a cool, dry, dark place not above 60°F /15°C, which would fit the characteristics of a root cellar. Yet since most people don't have root cellars, we'd suggest just keeping your sweet potatoes loose (not in a plastic bag, but if desired, a brown paper bag with multiple air holes punched in it will work) and storing them in a cool, dark, and well-ventilated cupboard away from sources of excess heat (like the stove).

How to Enjoy

A Few Quick Serving Ideas

- Purée cooked sweet potatoes with bananas, maple syrup and cinnamon. Top with chopped walnuts. The fat content of the walnuts will help you get optimal absorption of the beta-carotene in the sweet potatoes.
- Steam cubed sweet potatoes, tofu, and broccoli. Mix in raisins and serve hot or cold with a curried vinaigrette dressing. Once again, the oil in the vinaigrette will help you improve the bioavailability of the sweet potatoes' beta-carotene.
- Baked sweet potatoes are delicious even when served cold and therefore make a great food to pack in to-go lunches.

WHFoods Recipes That Feature Sweet Potatoes

- Indian Style Lamb with Sweet Potatoes
- Black Bean Burrito, Indian Style
- Braised Kidney Beans & Sweet Potato
- Curried Mustard Greens & Garbanzo Beans with Sweet Potatoes
- 7-Minute Sweet Potatoes
- Golden Spinach and Sweet Potato Healthy Sauté
- Healthy Mashed Sweet Potatoes
- Yams with Ginger and Cinnamon

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Sweet Potato, baked
1.00 cup
200.00 grams

Calories: 180
GI: medium

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin A	1921.80 mcg RAE	214	21.4	excellent
vitamin C	39.20 mg	52	5.2	very good
manganese	0.99 mg	50	5.0	very good
copper	0.32 mg	36	3.6	very good
pantothenic acid	1.77 mg	35	3.5	very good
vitamin B6	0.57 mg	34	3.4	very good
biotin	8.60 mcg	29	2.9	good
potassium	950.00 mg	27	2.7	good
fiber	6.60 g	26	2.6	good
vitamin B3	2.97 mg	19	1.9	good
vitamin B1	0.21 mg	18	1.8	good
vitamin B2	0.21 mg	16	1.6	good
phosphorus	108.00 mg	15	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Swiss chard

What's New and Beneficial About Swiss Chard

- We've become accustomed to thinking about vegetables as great sources of phytonutrients. Indeed they are! But we don't always appreciate how unique each vegetable can be in terms of its phytonutrient content. Recent research has shown that chard leaves contain at least 13 different polyphenol antioxidants, including kaempferol, the cardioprotective flavonoid that's also found in broccoli, kale, strawberries, and other foods. But alongside of kaempferol, one of the primary flavonoids found in the leaves of chard is a flavonoid called syringic acid. Syringic acid has received special attention in recent research due to its blood sugar regulating properties. This flavonoid has been shown to inhibit activity of an enzyme called *alpha-glucosidase*. When this enzyme gets inhibited, fewer carbs are broken down into simple sugars and blood sugar is able to stay more steady. It makes sense to think about chard as a vegetable whose flavonoid phytonutrients are unique and may offer special benefits for blood sugar control.
- Like beets, chard is a unique source of phytonutrients called betalains. In the betalain family are found reddish-purple betacyanin pigments as well as yellowish betaxanthin pigments. Both types can be found in chard! In the reddish-purple stems of chard and the reddish-purple veins in the leaves, scientists have identified at least 9 betacyanin pigments, including betanin, isobetanin, betanidin, and isobetanidin. In the yellowish stems and veins, at least 19 betaxanthin pigments have been identified, including histamine-betaxanthin, alanine-betaxanthin, tyramine-betaxanthin, and 3-methoxytyramine-betaxanthin. Many of the betalain pigments in chard have been shown to provide antioxidant, anti-inflammatory, and detoxification support. The detox support provided by betalains includes support of some especially important Phase 2 detox steps involving glutathione. So you can see that in the case of chard, beauty is far from just skin deep!

WHFoods Recommendations

Swiss chard is not only one of the most popular vegetables along the Mediterranean but it is one of the most nutritious vegetables around and ranks second only to spinach following our analysis of the total nutrient-richness of the World's Healthiest vegetables. It is also one of only three vegetables that we recommend boiling to help reduce its concentration of oxalic acid. Slice leaves 1-inch wide and the stems 1/2-inch wide and boil for just 3 minutes. We only recommend eating the stems of varieties with white stems; colored stems are very tough. For more on the Healthiest Way of Cooking Swiss Chard, see the How to Enjoy section below.

Foods belonging to the chenopod family—including beets, chard, spinach, and quinoa—continue to show an increasing number of health benefits not readily available from other food families. The red and yellow betalain pigments found in this food family, their unique epoxyxanthophyll carotenoids, and the special connection between their overall phytonutrients and our nervous system health (including our specialized nervous system organs like the eye) point to the chenopod family of foods as unique in their health value. While we have yet to see large-scale human studies that point to a recommended minimum intake level for foods from this botanical family, we have seen data on chenopod phytonutrients, and based on this data, we recommend that you include foods from the chenopod family in your diet 1-2 times per week. In the case of a leafy food like Swiss chard, we recommend a serving size of at least 1/2 cup, and even more beneficial, at least one full cup.

Swiss Chard, chopped, boiled
1.00 cup
(175.00 grams)

Calories: 35
GI: very low

Nutrient	DRI/DV
vitamin K	636%
vitamin A	60%
vitamin C	42%
magnesium	38%
copper	32%
manganese	29%
potassium	27%
vitamin E	22%
iron	22%
fiber	15%
choline	12%
vitamin B2	12%

calcium	10%
vitamin B6	9%
phosphorus	8%
protein	7%
pantothenic acid	6%
zinc	5%
vitamin B1	5%
vitamin B3	4%
folate	4%
selenium	3%

Health Benefits

Although chard has not been studied as extensively as other chenopod vegetables (like beets and spinach), there's no question about the valuable role that chard can play in support of our health, or about its routine inclusion in healthy diets worldwide. The amazing variety of phytonutrients in chard is quickly recognizable in its vibrant colors, including the rich, dark greens in its leaves and the rainbow of reds, purples, and yellows in its stalks and veins. Virtually all of these phytonutrients provide antioxidant benefits, anti-inflammatory benefits, or both. In addition, many provide health benefits that are more specific and of special important to particular body systems. Best researched in this area are phytonutrient benefits provided by chard for our body's blood sugar-regulating system.

Blood Sugar Benefits

Multiple studies on animals have shown that chard has unique benefits for blood sugar regulation. In addition, chard may provide special benefits in the diets of individuals diagnosed with diabetes. Although large-scale human studies have yet to be conducted in this area, lab studies and animal studies show that syringic acid—one of chard's premiere flavonoids—has the ability to inhibit activity of an enzyme called alpha-glucosidase. Alpha-glucosidase is an enzyme used to break down carbohydrates into simple sugars. When this enzyme gets inhibited, fewer carbs get broken down and blood sugar is able to stay more steady. This blood sugar-steadying process seems to be particularly true following a meal. In addition to its syringic acid, chard contains a very good amount of fiber (over 3.5 grams per cooked cup) and a very good amount of protein (once again, nearly 3.5 grams per cooked cup). Fiber and protein-rich foods are an excellent way to help stabilize blood sugar levels, since they help regulate the speed of digestion and keep food moving at the right pace through our digestive tract.

Also unique among the health benefits from this chenopod vegetable has been its ability to help pancreatic cells regenerate. At this point research on the beta cells of the pancreas has been restricted to animal studies, and instead of food-form chard, extracts from this plant have been used to evaluate potential benefits for the pancreas. Even though it's impossible to generalize from laboratory animals fed chard extracts to humans eating fresh chard, it's encouraging to see chard extracts providing this support to pancreatic beta cells. These cells, after all, are the cells responsible for production of insulin, and it's impossible for our blood sugar to be optimally regulated without the help of insulin. Expect to see follow-up research on the health benefits of chard for humans in this very important area of blood sugar regulation.

Although researchers aren't certain as to the exact nutrients involved, repeated studies on animals have also shown the ability of chard extracts to help protect the liver from damage in the case of animals with experimentally induced diabetes. Because liver protection can be an important goal in the management of diabetes in humans, this ability of chard to help protect the liver may be one additional reason why intake of this vegetable should be thought of as providing special benefits for blood sugar regulation and perhaps for dietary management of diabetes as well.

Antioxidant and Anti-Inflammatory Benefits

As an excellent source of vitamin C, vitamin E, vitamin A (in the form of beta-carotene) and the mineral manganese, and a good source of the mineral zinc, Swiss chard offers an outstanding variety of conventional antioxidants. But these conventional antioxidants are only part of chard's fantastic health benefits with respect to prevention of oxidative stress and diseases related to chronic, unwanted oxidative stress. Equally outstanding are chard's phytonutrient antioxidants. These phytonutrient antioxidants range from carotenoids like beta-carotene, lutein, and zeaxanthin to flavonoids like quercetin and kaempferol. But the range of phytonutrients in chard is even more extensive than researchers initially suspected, and at this point in time, about three dozen antioxidant phytonutrients have been identified in chard, including betalains (both betacyanins and betaxanthins) and epoxyxanthophylls. Many of these antioxidant phytonutrients provide chard with its colorful stems, stalks, and leaf veins.

As a rule, the phytonutrient antioxidants in chard also act as anti-inflammatory agents. Sometimes they lower risk of chronic, unwanted inflammation by altering the activity of pro-inflammatory enzymes. At other times, they help prevent the production of pro-inflammatory messaging molecules. Because chronic low level inflammation (especially when coupled with excessive oxidative stress) has repeatedly been shown to increase our risk of obesity, atherosclerosis, type 2 diabetes, high blood pressure, and several forms of arthritis, chard is very likely to show up in future studies on humans as a key vegetable for lowering risk of these health problems.

Support of Bone Health

With its very good supply of calcium and its excellent supply of magnesium and vitamin K, chard provides standout bone support.

Although many people have already learned about the connection between minerals like calcium and health of bones, the role of vitamin K in support of bone has not received nearly as much media attention. Vitamin K1 helps prevent excessive activation of osteoclasts, the cells that break down bone. Additionally, friendly bacteria in our intestines convert vitamin K1 into vitamin K2, which activates osteocalcin, the major non-collagen protein in bone. Osteocalcin anchors calcium molecules inside of the bone. All of these vitamin K-related mechanisms point to the importance of vitamin K-rich foods for bone health.

Description

Chard is a tall leafy green vegetable commonly referred to as Swiss chard and scientifically known as *Beta vulgaris*. Chard belongs to the same family as beets and spinach and shares a similar taste profile with a flavor that is bitter, pungent, and slightly salty. Swiss chard is truly one of the vegetable valedictorians with its exceptionally impressive list of health-promoting nutrients. Although Swiss chard is available throughout the year, its peak season runs from June through August when it is at its best and in the greatest abundance at your local supermarket.

Swiss chard—along with kale, mustard greens and collard greens—is one of several leafy green vegetables often referred to as "greens". It is a tall leafy green vegetable with a thick, crunchy stalk that comes in white, red or yellow with wide fan-like green leaves.

Chard has a thick, crunchy stalk to which fan-like wide green leaves are attached. The leaves may either be smooth or curly, depending upon the variety, and feature lighter-colored ribs running throughout. The stalk, which can measure almost two feet in length, comes in a variety of colors including white, red, yellow and orange. Sometimes, in the market, different colored varieties will be bunched together and labeled "rainbow chard."

History

Swiss chard isn't native to Switzerland. Its actual homeland of chard lies further south, in the Mediterranean region; in fact, the Greek philosopher, Aristotle wrote about chard in the fourth century B.C. This is not surprising given the fact that the ancient Greeks, and later the Romans, honored chard for its medicinal properties. Chard got its common name from another Mediterranean vegetable, cardoon, a celery-like plant with thick stalks that resemble those of chard. The French got the two confused and called them both "*carde*."

How to Select and Store

Choose chard that is held in a chilled display as this will help to ensure that it has a crunchier texture and sweeter taste. Look for leaves that are vivid green in color and that do not display any browning or yellowing. The leaves should not be wilted nor should they have tiny holes. The stalks should look crisp and be unblemished.

Do not wash Swiss chard before storing as the exposure to water encourages spoilage. Place chard in a plastic storage bag and wrap the bag tightly around the chard, squeezing out as much of the air from the bag as possible. Place in refrigerator where it will keep fresh for up to 5 days. If you have large batches of chard, you can blanch the leaves and then freeze them.

How to Enjoy

A Few Quick Serving Ideas

- Toss penne pasta with olive oil, lemon juice, garlic, and cooked Swiss chard.
- Add zest to omelets and frittatas by adding some boiled Swiss chard.
- Use chard in place of or in addition to spinach when preparing vegetarian lasagna.

WHFoods Recipes That Feature Swiss Chard

- Broiled Rosemary Chicken over Pureed Lentils
- Spicy Vegetable Tart
- 3-Minute Swiss Chard

Safety

Oxalate Content

Swiss chard has consistently been determined to have high oxalate content. Oxalates are naturally occurring organic acids found in a wide variety of foods, and in the case of certain medical conditions, they must be greatly restricted in a meal plan to prevent over-accumulation inside the body. Our comprehensive article about oxalates will provide you with practical and detailed information about these organic acids, food, and health.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Swiss Chard, chopped, boiled
1.00 cup
175.00 grams

Calories: 35
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin K	572.77 mcg	636	327.3	excellent
vitamin A	535.85 mcg RAE	60	30.6	excellent
vitamin C	31.50 mg	42	21.6	excellent
magnesium	150.50 mg	38	19.4	excellent
copper	0.29 mg	32	16.6	excellent
manganese	0.58 mg	29	14.9	excellent
potassium	960.75 mg	27	14.1	excellent
vitamin E	3.31 mg (ATE)	22	11.3	excellent
iron	3.96 mg	22	11.3	excellent
fiber	3.67 g	15	7.5	very good
choline	50.23 mg	12	6.1	very good
vitamin B2	0.15 mg	12	5.9	very good
calcium	101.50 mg	10	5.2	very good
vitamin B6	0.15 mg	9	4.5	very good
phosphorus	57.75 mg	8	4.2	very good
protein	3.29 g	7	3.4	very good
pantothenic acid	0.29 mg	6	3.0	good
zinc	0.58 mg	5	2.7	good
vitamin B1	0.06 mg	5	2.6	good
vitamin B3	0.63 mg	4	2.0	good

folate	15.75 mcg	4	2.0	good
selenium	1.57 mcg	3	1.5	good

World's Healthiest Foods Rating	**Rule**
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Tomatoes

What's New and Beneficial About Tomatoes

- Did you know that tomatoes do not have to be a deep red color to be an outstanding source of lycopene? Lycopene is a carotenoid pigment that has long been associated with the deep red color of many tomatoes. A small preliminary study on healthy men and women has shown that the lycopene from orange- and tangerine-colored tomatoes may actually be better absorbed than the lycopene from red tomatoes. That's because the lycopene in deep red tomatoes is mostly trans-lycopene, and the lycopene in orange/tangerine tomatoes is mostly tetra-cis-lycopene. In a recent study, this tetra-cis form of lycopene turned out to be more efficiently absorbed by the study participants. While more research is needed in this area, we're encouraged to find that tomatoes may not have to be deep red in order for us to get great lycopene-related benefits.
- Tomatoes are widely known for their outstanding antioxidant content, including, of course, their oftentimes-rich concentration of lycopene. Researchers have recently found an important connection between lycopene, its antioxidant properties, and bone health. A study was designed in which tomato and other dietary sources of lycopene were removed from the diets of postmenopausal women for a period of 4 weeks, to see what effect lycopene restriction would have on bone health. At the end of 4 weeks, women in the study started to show increased signs of oxidative stress in their bones and unwanted changes in their bone tissue. The study investigators concluded that removal of lycopene-containing foods (including tomatoes) from the diet was likely to put women at increased risk of osteoporosis. They also argued for the importance of tomatoes and other lycopene-containing foods in the diet. We don't always think about antioxidant protection as being important for bone health, but it is, and tomato lycopene (and other tomato antioxidants) may have a special role to play in this area.
- There are literally hundreds of different tomato varieties. We usually choose our favorite varieties by some combination of flavor, texture, and appearance. But a recent study has shown that we may also want to include antioxidant capacity as a factor when we are choosing among tomato varieties. Surprisingly, researchers who compared conventionally grown versus organically grown tomatoes found that growing method (conventional versus organic) made less of an overall difference than variety of tomato. While all tomatoes showed good antioxidant capacity, and while the differences were not huge, the following four varieties of tomatoes turned out to have a higher average antioxidant capacity regardless of whether they were grown conventionally or organically: New Girl, Jet Star, Fantastic, and First Lady. It's only one study, of course, and we're definitely not ready to recommend these four varieties at the exclusion of all others. But these findings are fascinating to us, and they suggest that specific types of nutrient benefits may be provided by specific varieties of tomatoes. Also, if you're seeking good antioxidant protection and you're in the grocery standing in front of a New Girl, Jet Star, Fantastic, or First Lady tomato, you would probably be well-served to place it in your shopping cart.
- Intake of tomatoes has long been linked to heart health. Fresh tomatoes and tomato extracts have been shown to help lower total cholesterol, LDL cholesterol, and triglycerides. In addition, tomato extracts have been shown to help prevent unwanted clumping together (aggregation) of platelet cells in the blood - a factor that is especially important in lowering risk of heart problems like atherosclerosis. (In a recent South American study of 26 vegetables, tomatoes and green beans came out best in their anti-aggregation properties.) But only recently are researchers beginning to identify some of the more unusual phytonutrients in tomatoes that help provide us with these heart-protective benefits. One of these phytonutrients is a glycoside called esculeoside A; another is flavonoid called chalconaringenin; and yet another is a fatty-acid type molecule called 9-oxo-octadecadienoic acid. As our knowledge of unique tomato phytonutrients expands, we are likely to learn more about the unique role played by tomatoes in support of heart health. Tomatoes are also likely to rise further and further toward the top of the list as heart healthy foods.

Tomatoes, sliced, raw
1.00 cup
(180.00 grams)

Calories: 32
GI: very low

Nutrient	DRI/DV
vitamin C	33%
biotin	24%
molybdenum	20%
vitamin K	16%
potassium	12%
copper	12%
manganese	11%
fiber	9%
vitamin A	8%

vitamin B6	8%
vitamin B3	7%
folate	7%
phosphorus	6%
vitamin B1	6%
vitamin E	6%
magnesium	5%
chromium	4%
iron	3%
zinc	3%
choline	3%
pantothenic acid	3%
protein	3%

Health Benefits

Tomatoes are a treasure of riches when it comes to their antioxidant benefits. In terms of conventional antioxidants, tomatoes provide an excellent amount of vitamin C and beta-carotene; a very good amount of the mineral manganese; and a good amount of vitamin E. In terms of phytonutrients, tomatoes are basically off the chart, and include:

- Flavonones
    - naringenin
    - chalconaringenin
- Flavonols
    - rutin
    - kaempferol
    - quercetin
- Hydroxycinnamic acids
    - caffeic acid
    - ferulic acid
    - coumaric acid
- Carotenoids
    - lycopene
    - lutein
    - zeaxanthin
    - beta-carotene
- Glycosides
    - esculeoside A
- Fatty acid derivatives
    - 9-oxo-octadecadienoic acid

Specific antioxidant nutrients found in tomatoes, whole tomato extracts, and overall dietary intake of tomatoes have all been associated with antioxidant protection. Sometimes this protection comes in the form of reduced lipid peroxidation (oxygen damage to fats in cell membranes or in the bloodstream). Sometimes this protection comes in the form of better antioxidant enzyme function (for example, better function of the enzymes catalase or superoxide dismustase). Better antioxidant protection has also been shown using broad measurements of oxidative stress in different body systems. We've seen studies involving tomato and specific antioxidant protection of the bones, liver, kidneys, and bloodstream.

Cardiovascular Support

Reduced risk of heart disease is an area of health benefits in which tomatoes truly excel. There are two basic lines of research that have repeatedly linked tomatoes to heart health. The first line of research involves antioxidant support, and the second line of research involves regulation of fats in the bloodstream.

No body system has a greater need for antioxidant protection than the cardiovascular system. The heart and bloodstream are responsible for taking oxygen breathed in through the lungs and circulating it around throughout the body. In order to keep this oxygen in check, antioxidant nutrients are needed in an ample supply. Earlier in this Health Benefits section, we gave you a close-up look at some of the best-researched antioxidants in tomatoes. It's worth noting here that conventional vitamin antioxidants like vitamin E and vitamin C are sometimes overlooked in tomatoes because of their unique phytonutrient composition. Yet vitamin E and vitamin C provide critical antioxidant support in the cardiovascular system, and they are an important part of the contribution made by tomatoes to our heart health. It's the carotenoid lycopene, however, that has gotten the most attention as tomatoes' premier antioxidant and heart-supportive nutrient. Lycopene (and a related group of nutrients) has the ability to help lower the risk of lipid peroxidation in the bloodstream. Lipid peroxidation is a process in which fats that are located in the membranes of cells lining the bloodstream, or fats that are being carried around in the blood, get damaged by oxygen. This damage can be repaired if it is kept at manageable levels. However, chronic and/or excessive lipid peroxidation in the bloodstream leads to trouble. Overly damaged fat components sound an alarm to the body's immune and inflammatory systems, and the result is a series of processes that can lead to a gradual blocking of blood vessels (atherosclerosis) or other problems.

The second line of research linking tomatoes with heart health involves regulation of fats in the blood. Dietary intake of tomatoes, consumption of tomato extracts, and supplementation with tomato phytonutrients (like lycopene) have all been shown to improve the profile of fats in our bloodstream. Specifically, tomato intake has been shown to result in decreased total cholesterol, decreased LDL cholesterol, and decreased triglyceride levels. It's also been shown to decrease accumulation of cholesterol molecules inside of macrophage cells. (Macrophage cells are a type of white blood cell that gets called into action when oxidative stress in the bloodstream gets too high, and the activity of macrophages—including their accumulation of cholesterol—is a prerequisite for development of atherosclerosis.) Many phytonutrients in tomatoes are likely to be involved with the improvement of our blood fat levels. Two little-known phytonutrients—one called esculeoside A and the other called 9-oxo-octadecadienoic acid—are currently under active investigation by researchers as tomato phytonutrients especially important in blood fat regulation.

Yet another area of increasing interest in tomatoes and heart health involves blood cells called platelets. The excessive clumping together of platelet cells can cause problems for our bloodstream in terms of blockage and unwanted clotting, and prevention of this excessive clumping is important for maintaining heart health. Numerous phytonutrients in tomatoes have been shown to help prevent excessive clumping of our platelet cells. (This ability is usually referred to as an "antiaggregatory effect.") In combination with the other heart benefits described above, this platelet-regulating impact of tomatoes puts them in a unique position to help us optimize our cardiovascular health.

Supports Bone Health

Bone health is another area of growing interest in tomato research. Interestingly, the connection of tomato intake to bone health involves the rich supply of antioxidant in tomatoes. We don't always think about antioxidant protection as being important for bone health, but it is; and tomato lycopene (and other tomato antioxidants) may have a special role to play in this area. In a recent study, tomato and other dietary sources of lycopene were removed from the diets of postmenopausal women for a period of 4 weeks to see what effect lycopene restriction would have on bone health. At the end of 4 weeks, women in the study started to show increased signs of oxidative stress in their bones and unwanted changes in their bone tissue. We expect to see follow-up studies in this area that will hopefully determine exactly what levels of tomato intake are most helpful in protecting bone tissue.

Anti-Cancer Benefits

While not well researched for all cancer types, tomatoes have repeatedly been show to provide us with anti-cancer benefits. The track record for tomatoes as a cancer-protective food should not be surprising, since there is a very large amount of research on tomato antioxidants and a more limited but still important amount of research on tomato anti-inflammatory nutrients. Risk for many cancer types starts out with chronic oxidative stress and chronic unwanted inflammation. For this reason, foods that provide us with strong antioxidant and anti-inflammatory support are often foods that show cancer prevention properties.

Prostate cancer is by far the best-researched type of cancer in relationship to tomato intake. The jury verdict here is clear: tomatoes can definitely help lower risk of prostate cancer in men. One key tomato nutrient that has received special focus in prostate cancer prevention is alpha-tomatine. Alpha-tomatine is a saponin phytonutrient and it's shown the ability to alter metabolic activity in developing prostate cancer cells. It's also been shown to trigger programmed cell death (apoptosis) in prostate cancer cells that have already been fully formed. Research on alpha-tomatine has also been conducted for non-small cell lung cancer, with similar findings.

Along with prostate cancer and non-small cell lung cancer, pancreatic cancer and breast cancer are the two best-studied areas involving tomatoes and cancer risk. Research on tomatoes and breast cancer risk has largely focused on the carotenoid lycopene, and there is fairly well documented risk reduction for breast cancer in association with lycopene intake.

Other Health Benefits

While not as thoroughly researched as these other areas of antioxidant support, cardiovascular support, and anti-cancer benefits, several other health benefit areas are important to mention with respect to tomatoes. Diets that include tomatoes have been linked with reduced risk of some neurological diseases (including Alzheimer's disease) in multiple studies. Tomato-containing diets have also been linked in a few studies with reduced risk of obesity.

Description

The tomato is the fruit of the plant *Lycopersicon esculentum*. (Botanically speaking, tomato is not only a fruit, but also a berry since it is formed from a single ovary.) Originally, tomato was named after the food family to which it belongs - the *Solanaceae* (sometimes called "solanoid" or "nightshade") family. The botanical name *Solanum lycopersicum* for tomatoes has now largely been replaced by the name *Lycopersicon esculentum*. (The genus/species name *Lycopersicon esculentum* is also sometimes used to refer to tomatoes.)

The French sometimes refer to the tomato as pomme d'amour, meaning "love apple," and in Italy, tomato is sometimes referred to as "pomodoro" or "golden apple," probably referring to tomato varieties that were yellow/orange/tangerine in color.

Regardless of its name, the tomato is a wonderfully popular and versatile food that comes in over a thousand different varieties that vary in shape, size, and color. There are small cherry tomatoes, bright yellow tomatoes, Italian pear-shaped tomatoes, and the green tomato, famous for its fried preparation in Southern American cuisine.

Only the fruits of this plant are eaten since the leaves often contain potentially problematic concentrations of certain alkaloids (see Individual Concerns section below). Tomatoes have fleshy internal segments filled with slippery seeds surrounded by a watery matrix. They can be red, pink, yellow, orange/tangerine, green, purple, brown, or black in color.

Beefsteak and beef master tomatoes are among the largest-sized varieties. Roma tomatoes are more of an intermediate size, while cherry and grape tomatoes are small and rounded. The term "heirloom tomatoes" has become somewhat confusing as it can have a variety of different meanings. In the most traditional sense, "heirloom" refers to seeds from tomato cultivars that get handed down over time from family to family. Obviously, seeds handed down in this way do not make it possible for tomato production on a very large commercial scale. Yet there are definitely "commercial heirloom" tomatoes in the marketplace (sometimes produced from cross-breeding and sometimes produced through open pollination.)

Although tomatoes are fruits in a botanical sense, they don't have the dessert quality sweetness of other fruits. Instead they have a subtle sweetness that is complemented by a slightly bitter and acidic taste. They are prepared and served like other vegetables, which is why they are often categorized as such, including in our A-Z List of the World's Healthiest Foods. Cooking tempers the acid and bitter qualities in tomatoes and brings out their warm, rich sweetness.

There are few food sensations that better mark the summer and early fall months than the sweet juiciness of a vine-ripened tomato. Although tomatoes are available year-round across the U.S., some of the most delicious tomato flavors come from fresh tomatoes that have been planted in late spring or early summer and ripen from July through September.

History

Although tomatoes are often closely associated with Italian cuisine, they are actually originally native to the western side of South America, in the region occupied by Columbia, Ecuador, Peru, Chile, and the western half of Bolivia. The Galapagos Islands off the coast of Ecuador are also believed to be part of tomatoes' native area. The first type of tomato grown is thought to have more resembled the smaller-sized cherry tomato than the larger varieties.

The tomato does not appear to have been first cultivated in South America, however, but rather in Mexico, most likely in Aztec civilizations and probably in the form of small yellow fruits. The word "tomato" may actually originate from the Nahautl (Aztecan) word "*tomatl* " meaning "the swelling fruit." It wasn't until the 1500's that Spanish explorers and colonizers brought tomato seeds from Mexico back to Spain and introduced this food to European populations.

Although the use of tomatoes spread throughout Europe (including Italy) over the course of the 1500's, tomatoes did not enjoy full popularity then and were seen by many people as unfit to eat. Part of this "food inappropriateness" was associated with the status of the tomato plant as a nightshade plant and its potential poisonousness in this regard. (It's true, of course, that tomatoes belong to the *Solanaceae* or nightshade family of plants, along with potatoes, sweet and hot peppers, eggplant, tomatillos, tamarios, pepinos, pimentos, paprika, and cayenne. It's also true that tomatoes contain alkaloids —substances that even in small doses can be associated with adverse reactions in sensitive individuals. But it's also true that the levels of alkaloids found in nightshade foods are well-tolerated by many individuals in diets worldwide. For more on nightshades, please see our article "What are nightshades and in which foods are they found?")

Today tomatoes are enjoyed worldwide—to the tune of about 130 million tons per year. The largest tomato-producing country is China (with approximately 34 million tons of production), followed by the United States, Turkey, India, and Italy.

In the U.S., cultivation of tomato varieties is usually determined by their final destination: (1) consumption in fresh form by consumers or (2) use in processing by manufacturers of tomato products. Tomato processors need varieties that have a greater proportion of soluble solids in order to make products like tomato paste more efficiently. Between 80-90% of all commercial tomato cultivation in the U.S. is cultivation for eventual use in processing. (Processing tomatoes are needed for the manufacturing of pasta sauces, pizza sauces, and tomato pastes. Both processing and fresh market tomatoes may be used in the production of salsa—although fresh market tomato salsas or homemade salsas—like our Fresh Tomato Salsa—are the salsas that we like best on account of their minimal processing.) California and Florida produce about two-thirds of all commercially grown fresh market tomatoes in the U.S. During the winter months, because Florida tomatoes are generally shipped to other states along the east coast of the U.S., imported Mexican tomatoes make up a high percentage of commercially grown fresh tomatoes along the west coast.

How to Select and Store

Choose tomatoes that have rich colors. Deep reds are a great choice, but so are vibrant oranges/tangerines, brilliant yellows, and rich purples. Tomatoes of all colors provide outstanding nutrient benefits. Tomatoes should be well shaped and smooth skinned with no wrinkles, cracks, bruises, or soft spots. They should not have a puffy appearance since that characteristic is often associated with inferior flavor and may also result in excess waste during preparation. Ripe tomatoes will yield to slight pressure and will have a noticeably sweet fragrance.

When buying canned tomatoes, it is often better to buy those that are produced in the United States as many foreign countries do not have as strict standards for lead content in containers. This is especially important with a fruit such as tomatoes, whose high acid content can cause corrosion to, and subsequent migration into the foods of, the metals with which it is in contact.

While on the topic of canning, you may also be interested in some of the most recent information about canned tomato products and BPA (bisphenol A). BPA is an added component in the vinyl lining of numerous canned foods, and it's also known to be problematic from a health standpoint because of its impact on estrogen metabolism. (For more extensive information about BPA, click here.) A recent study of canned foods in Canada has shown an average of about 1 ppb of BPA in canned tomato paste products (with a maximum amount of about 2 ppb), and an average of 9 ppb in pure tomato products liked diced, sliced, or whole peeled tomatoes (with a maximum amount of about 23 ppm). While the U.S. Food and Drug Administration has not set a limit on the amount of BPA allowed in canned tomatoes, the European Commission Directive for BPA has set a limit of 600 ppb. While any amount of BPA in canned tomatoes seems undesirable, we are glad to see that the BPA levels were fairly low in this recent study, especially in canned tomato paste products. You'll need to look for a claim of "BPA-Free" on the label of your canned tomato products (or call the manufacturer) if you want to be sure that your canned tomatoes contain no BPA, since even some certified organic canned tomato products may contain—and are allowed to contain—BPA (through migration from the can).

Since tomatoes are sensitive to cold, and it will impede their ripening process, store them at room temperature and out of direct exposure to sunlight. They will keep for up to a week, depending upon how ripe they are when purchased. To hasten the ripening process, place them in a paper bag with a banana or apple since the ethylene gas that these fruits emit will help speed up the tomato's maturation. If the tomatoes begin to become overripe, but you are not yet ready to eat them, place them in the refrigerator (if possible, in the butter compartment which is a warmer area), where they will keep for one or two more days. Removing them from the refrigerator about 30 minutes before using will help them to regain their maximum flavor and juiciness. Whole tomatoes, chopped tomatoes and tomato sauce freeze well for future use in cooked dishes. Sun-dried tomatoes should be stored in an airtight container, with or without olive oil, in a cool dry place.

Ketchup can be a surprisingly good source of tomato nutrients, including lycopene. But if you are going to purchase tomatoes in the form of ketchup, we recommend that you choose organic ketchup. We make this recommendation not only because you're likely to avoid unwanted pesticide residues and other contaminants if you purchase organic, but also because we've seen a recent study showing higher lycopene content in organic versus non-organic ketchup.

How to Enjoy

A Few Quick Serving Ideas

- To make your own tomato paste, simply Healthy Sauté a couple of cloves of chopped garlic and/or 1 or 2 large chopped onions for a couple of minutes until they are translucent. Add 8 to 10 chopped whole tomatoes and a teaspoon of dried—

or several teaspoons of fresh chopped—oregano, basil, and any other herbs you enjoy (such as parsley or rosemary). Simmer for 30-45 minutes. Remove from the heat, drizzle with olive oil, and add sea salt and freshly ground black pepper to taste. For a fancier version, Healthy Sauté chopped olives and/or mushrooms along with the garlic and onions.
- Tomatoes are a great addition to bean and vegetable soups.
- Enjoy a classic Italian salad—sliced onions, tomatoes and mozzarella cheese drizzled with olive oil.
- Combine chopped onions, tomatoes, and chili peppers for an easy-to-make salsa dip.
- Puree tomatoes, cucumbers, bell peppers and scallions together in a food processor and season with herbs and spices of your choice to make the refreshing cold soup, gazpacho.
- Add tomato slices to sandwiches and salads. To keep things colorful, use yellow, green and purple tomatoes in addition to red ones.

WHFoods Recipes That Include Tomatoes

- Mushroom, Tomato, Basil Frittata
- 15-Minute Salmon with Tomato Salsa
- Mediterranean Cod with Tomatoes
- Fresh Tomato Salsa
- Mediterranean Tomato Salad
- Fresh Tomato Salsa
- Tomato Dandelion Salad
- Pureed Lima Beans with Rosemary Tomato Broth

Safety

Tomatoes Belong to the Nightshade Family

Tomatoes are one of the vegetables that belong to the nightshade (Solanaceae) family. For helpful information about nightshade vegetables—including our WHFoods Recommendations—please see our article, Which foods are classified as "nightshades," and is it true that foods from this group can potentially contain problematic substances?

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Tomatoes, sliced, raw **1.00 cup** **180.00 grams**				**Calories: 32** **GI: very low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin C	24.66 mg	33	18.3	excellent
biotin	7.20 mcg	24	13.3	excellent
molybdenum	9.00 mcg	20	11.1	excellent
vitamin K	14.22 mcg	16	8.8	excellent
copper	0.11 mg	12	6.8	very good
potassium	426.60 mg	12	6.8	very good
manganese	0.21 mg	11	5.8	very good
fiber	2.16 g	9	4.8	very good
vitamin A	74.97 mcg RAE	8	4.6	very good
vitamin B6	0.14 mg	8	4.6	very good

folate	27.00 mcg	7	3.8	very good
vitamin B3	1.07 mg	7	3.7	very good
vitamin E	0.97 mg (ATE)	6	3.6	very good
phosphorus	43.20 mg	6	3.4	very good
vitamin B1	0.07 mg	6	3.2	good
magnesium	19.80 mg	5	2.8	good
chromium	1.26 mcg	4	2.0	good
pantothenic acid	0.16 mg	3	1.8	good
protein	1.58 g	3	1.8	good
choline	12.06 mg	3	1.6	good
zinc	0.31 mg	3	1.6	good
iron	0.49 mg	3	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Turnip greens

What's New and Beneficial About Turnip Greens

- The noticeably bitter taste of turnip greens has been linked by researchers to its calcium content. On an ounce-for-ounce basis, turnip greens contain about 4 times more calcium than a much less bitter-tasting cruciferous vegetable like cabbage. And in our food rating system, turnip greens rank as the fourth most concentrated source of this mineral. It's not calcium per se that is associated with the bitterness of turnip greens (and many other plant foods), but the varying forms of calcium that are contained within plant foods. (Included in these forms might be calcium chloride, calcium sulfate, calcium lactate, calcium pectate, and other forms.) Of course, high calcium content is by no means the only reason for the noticeable bitterness of turnip greens. Numerous other naturally-present constituents - including alkaloids, glucosinolates, terpenoids, flavonoids, tannins, sulfimides, and lactones - can contribute to the bitter taste that most people associated with these greens in their raw form. Since many of the molecules listed above also provide well-documented health benefits, the "trick" to getting great nourishment from turnip greens while at the same time enjoying a taste that is not overwhelmed with excessive bitterness is to use a cooking method and a recipe that will bring out the delicious potential of this vegetable in a flavor-blended way. Our recommended cooking method for turnip greens and our turnip green recipes will do exactly that!
- For total glucosinolate content, turnip greens outscore cabbage, kale, cauliflower, and broccoli among the most commonly eaten cruciferous vegetables. That fantastic glucosinolate content brings with it some equally fantastic health benefits. The glucosinolates in turnip greens are phytonutrients that can be converted into isothiocyanates (ITCs) with cancer-preventing properties. All cruciferous vegetables have long been known to contain glucosinolates, but it has taken recent research to show us exactly how valuable turnip greens are in this regard.

WHFoods Recommendations

You'll want to include turnip greens as one of the cruciferous vegetables you eat on a regular basis if you want to receive the fantastic health benefits provided by the cruciferous vegetable family. At a minimum, we recommend 3/4 cup of cruciferous vegetables on a daily basis. This amount is equivalent to approximately 5 cups per week. A more optimal intake amount would be 1-1/2 cups per day, or about 10 cups per week. You can use our Veggie Advisor for help in figuring out your best cruciferous vegetable options.

We recommend Healthy Steaming turnip greens for maximum nutrition and flavor. Cut greens into 1/2-inch slices and let sit for at least 5 minutes to enhance it health-promoting benefits and steam for 5 minutes. Toss with our Mediterranean Dressing (see Healthiest Way to Cook Turnip Greens in the How to Enjoy section below).

Turnip Greens, cooked
1.00 cup
(144.00 grams)

Calories: 29
GI: very low

Nutrient	DRI/DV
vitamin K	588%
vitamin A	61%
vitamin C	53%
folate	42%
copper	40%
manganese	25%
fiber	20%
calcium	20%
vitamin E	18%
vitamin B6	15%
potassium	8%
vitamin B2	8%
magnesium	8%
pantothenic acid	8%
iron	6%
phosphorus	6%
vitamin B1	5%
omega-3 fats	4%

vitamin B3	4%
protein	3%

Health Benefits

Unlike some of their fellow cruciferous vegetables, turnip greens have not been the direct focus of most health-oriented research studies. However, turnip greens have sometimes been included in a longer list of cruciferous vegetables that have been lumped together and studied to determine potential types of health benefits. Based upon several dozen studies involving cruciferous vegetables as a group (and including turnip greens on the list of vegetables studied), cancer prevention appears to be a standout area for turnip greens when summarizing health benefits.

This connection between turnip greens and cancer prevention should not be surprising since turnip greens provide special nutrient support for three body systems that are closely connected with cancer development as well as cancer prevention. These three systems are (1) the body's detox system, (2) its antioxidant system, and (3) its inflammatory/anti-inflammatory system. Chronic imbalances in any of these three systems can increase risk of cancer, and when imbalances in all three systems occur simultaneously, the risk of cancer increases significantly. Among all types of cancer, prevention of the following cancer types is most closely associated with intake of turnip greens: bladder cancer, breast cancer, colon cancer, lung cancer, prostate cancer, and ovarian cancer.

Detox Support

The detox support provided by turnip greens includes antioxidant nutrients to boost Phase 1 detoxification activities and sulfur-containing nutrients to boost Phase 2 activities. Turnip greens also contain phytonutrients called glucosinolates that can help activate detoxification enzymes and regulate their activity. Two key glucosinolates that have been clearly identified in turnip greens in significant amounts are gluconasturtiian and glucotropaeolin.

If we fail to give our body's detox system adequate nutritional support, yet continue to expose ourselves to unwanted toxins through our lifestyle and our dietary choices, we can place our bodies at increased risk of toxin-related damage that can eventually increase our cells' risk of becoming cancerous. That's one of the reasons it's so important to bring turnip greens and other cruciferous vegetables into our diet on a regular basis.

Antioxidant Benefits

As an excellent source of vitamin C, vitamin E, beta-carotene, and manganese, turnip greens provide highest level support for four conventional antioxidant nutrients. But the antioxidant support provided by turnip greens extends far beyond these conventional nutrients and into the realm of phytonutrients. Hydroxycinnamic acid, quercetin, myricetin, isorhamnetin, and kaempferol are among the key antioxidant phytonutrients provided by turnip greens. This broad spectrum antioxidant support helps lower the risk of oxidative stress in our cells. Chronic oxidative stress—meaning chronic presence over overly reactive oxygen-containing molecules and cumulative damage to our cells by these molecules—is a risk factor for development of most cancer types. By providing us with a diverse array of antioxidant nutrients, turnip greens help lower our cancer risk by helping us avoid chronic and unwanted oxidative stress.

Anti-inflammatory Benefits

As an excellent source of vitamin K and a good source of omega-3 fatty acids (in the form of alpha-linolenic acid, or ALA), turnip greens provide us with two hallmark anti-inflammatory nutrients. Vitamin K acts as a direct regulator of our inflammatory response, and ALA is the building block for several of the body's most widely-used families of anti-inflammatory messaging molecules. While glucobrassicin (a glucosinolate found in many cruciferous vegetables, and the precursor for the anti-inflammatory molecule indole-3-carbinol) does not appear to be present in turnip greens in significant amounts, other glucosinolates present in turnip greens may provide important anti-inflammatory benefits and are the subject of current research.

Like chronic oxidative stress and chronic weakened detox ability, chronic unwanted inflammation can significantly increase our risk of cancers and other chronic diseases (especially cardiovascular diseases).

Cardiovascular Support

Researchers have looked at a variety of cardiovascular problems—including heart attack, ischemic heart disease, and atherosclerosis—and found preliminary evidence of an ability on the part of cruciferous vegetables to lower our risk of these health problems. Yet regardless of the specific cardiovascular problem, it is one particular type of cardiovascular benefit that has most interested researchers, and that benefit is the anti-inflammatory nature of turnip greens and their fellow cruciferous vegetables. Scientists have not always viewed cardiovascular problems as having a central inflammatory component, but the role of unwanted inflammation in creating problems for our blood vessels and circulation has become increasingly fundamental to an understanding of cardiovascular diseases. While glucoraphanin (a glucosinolate found in many cruciferous vegetables, and the precursor for sulforaphane, an isothiocyanate with important anti-inflammatory properties) does not appear to be present in turnip greens in significant amounts, other glucosinolates present in turnip greens may provide important anti-inflammatory benefits and are the subject of current research.

A second area you can count on turnip greens for cardiovascular support involves their cholesterol-lowering ability. Our liver uses cholesterol as a basic building block to product bile acids. Bile acids are specialized molecules that aid in the digestion and absorption of fat through a process called emulsification. These molecules are typically stored in fluid form in our gall bladder, and when we eat a fat-containing meal, they get released into the intestine where they help ready the fat for interaction with enzymes and eventual absorption up into the body. When we eat turnip greens, fiber-related nutrients in this cruciferous vegetable bind together with some of the bile acids in the intestine in such a way that they simply stay inside the intestine and pass out of our body in a bowel movement, rather than getting absorbed along with the fat they have emulsified. When this happens, our liver needs to replace the lost bile acids by drawing upon our existing supply of cholesterol, and as a result, our cholesterol level drops down. Turnip greens provide us with this cholesterol-lowering benefit whether they are raw or cooked. However, a recent study has shown that the cholesterol-lowering ability of raw turnip greens improves significantly when they are steamed. In fact, when the cholesterol-lowering ability of steamed turnip greens was compared with the cholesterol-lowering ability of the prescription drug cholestyramine (a medication that is taken for the purpose of lowering cholesterol), mustard greens bound 34% as many bile acids (based on a standard of comparison involving total dietary fiber).

It's impossible to talk about the cardiovascular benefits of turnip greens without also mentioning their exceptional folate content. Although this cruciferous vegetable scores a rating of "excellent" in our food rating system, we would like to point out just how "excellent" excellent is when you're talking about turnip greens. These greens provide 575 micrograms of folate in every hundred calories. That's an amount that is unsurpassed by the most commonly-eaten cruciferous vegetables! Folate is a critical B-vitamin for support of cardiovascular health, including its key role in prevention of homocysteine build-up (called hyperhomocysteinemia).

Digestive Support

The fiber content of turnip greens—over 5 grams in every cup—makes this cruciferous vegetable a natural choice for digestive system support. And although not yet confirmed in large-scale human research studies, we eventually expect to see some special digestive benefits coming from turnip greens in the area of glucosinolates, isothiocyanates, and stomach bacteria. While glucoraphanin (a glucosinolate found in many cruciferous vegetables, and the precursor for sulforaphane, an isothiocyanate with important properties involving regulation of a stomach bacteria called *Helicobacter pylori*) does not appear to be present in turnip greens in significant amounts, other glucosinolates present in turnip greens may provide similar health benefits with respect to prevention of *Helicobacter pylori* overgrowth in our stomach or too much clinging by this bacterium to our stomach wall.

Description

All cruciferous vegetables provide integrated nourishment across a wide variety of nutritional categories and provide broad support across a wide variety of body systems as well. For more on cruciferous vegetables see:

- Eating Healthy with Cruciferous Vegetables
- Feeling Great with Cruciferous Vegetables

Turnip greens are the leaves of the turnip plant, better known for its tasty root. Turnip, which scientifically known as *Brassica rapa*, belongs to the *Cruciferae* family, a cousin to other health-protective giants including kale, collards, cabbage, and broccoli.

Turnip leaves are smaller and more tender than their cousin, collards. Their slightly bitter flavor is delicious. Turnip greens are an important vegetable in traditional Southern American cooking.

History

Turnips are an ancient vegetable that is thought to have been cultivated almost 4,000 years ago in the Near East. Both the Greeks and Romans thought highly of the turnip and developed several new varieties. Its widespread popularity in Europe has continued, although since the advent of the potato, it is less widely cultivated than it once was.

Turnips were introduced into North America by the early European settlers and colonists. They grew well in the South and became a popular food in the local cuisine of this region. Turnip greens, which became an integral part of Southern African-American cuisine, are thought to have been adopted into this food culture because of the role they played during the days of slavery. Supposedly, the slave owners would reserve the turnip roots for themselves, leaving the leaves for the slaves. As Western African cuisine traditionally utilizes a wide variety of green leaves in its cooking, the African slaves adopted turnip greens as a substitute and incorporated them into their foodways.

How to Select and Store

Turnip greens are usually available with their roots attached. Look for greens that are unblemished, crisp, and deep green in color.

If you have purchased turnip greens with roots attached, remove them from the root. Store root and greens in separate plastic bags, removing as much of the air from the bags as possible. Place in refrigerator where the greens should keep fresh for about 4 days.

How to Enjoy

A Few Quick Serving Ideas

- Serve healthy sautéed turnip greens seasoned with some soy sauce, lemon juice and cayenne pepper
- Make a simple meal with a little Southern inspiration. Serve cooked turnip greens with beans and rice.
- Healthy sauté turnip greens, sweet potatoes and tofu, and serve alongside your favorite grain.
- Use turnip greens in addition to spinach when making vegetarian lasagna.

Safety

Turnip Greens and Goitrogens

You may sometimes hear turnip greens being described as a food that contains "goitrogens," or as a food that is "goitrogenic." For helpful information in this area—including our WHFoods Recommendations—please see our article What is meant by the term "goitrogen" and what is the connection between goitrogens, food, and health?.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Turnip Greens, cooked **1.00 cup** **144.00 grams**				**Calories: 29** **GI: very low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin K	529.34 mcg	588	367.6	excellent
vitamin A	549.00 mcg RAE	61	38.1	excellent
vitamin C	39.46 mg	53	32.9	excellent

folate	169.92 mcg	42	26.5	excellent
copper	0.36 mg	40	25.0	excellent
manganese	0.49 mg	25	15.3	excellent
fiber	5.04 g	20	12.6	excellent
calcium	197.28 mg	20	12.3	excellent
vitamin E	2.71 mg (ATE)	18	11.3	excellent
vitamin B6	0.26 mg	15	9.6	excellent
potassium	292.32 mg	8	5.2	very good
magnesium	31.68 mg	8	4.9	very good
pantothenic acid	0.39 mg	8	4.9	very good
vitamin B2	0.10 mg	8	4.8	very good
iron	1.15 mg	6	4.0	very good
phosphorus	41.76 mg	6	3.7	very good
vitamin B1	0.06 mg	5	3.1	good
omega-3 fats	0.09 g	4	2.3	good
vitamin B3	0.59 mg	4	2.3	good
protein	1.64 g	3	2.0	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Apples

What's New and Beneficial About Apples

- The phytonutrients in apples can help you regulate your blood sugar. Recent research has shown that apple polyphenols can help prevent spikes in blood sugar through a variety of mechanisms. Flavonoids like quercetin found in apples can inhibit enzymes like alpha-amylase and alpha-glucosidase. Since these enzymes are involved in the breakdown of complex carbohydrates into simple sugars, your blood sugar has fewer simple sugars to deal with when these enzymes are inhibited. In addition, the polyphenols in apple have been shown to lessen absorption of glucose from the digestive tract; to stimulate the beta cells of the pancreas to secrete insulin; and to increase uptake of glucose from the blood via stimulation of insulin receptors. All of these mechanisms triggered by apple polyphenols can make it easier for you to regulate your blood sugar.
- Even though apple is not an excellent source of dietary fiber (it ranks as a "good" source in our WHFoods Rating System), the fiber found in apple may combine with other apple nutrients to provide you with the kind of health benefits you would ordinarily only associate with much higher amounts of dietary fiber. These health benefits are particularly important in prevention of heart disease through healthy regulation of blood fat levels. Recent research has shown that intake of apples in their whole food form can significantly lower many of our blood fats. The fat-lowering effects of apple have traditionally been associated with its soluble fiber content, and in particular, with the soluble fiber portion of its polysaccharide component known as pectins. What we now know, however, is that whole apples only contain approximately 2-3 grams of fiber per 3.5 ounces, and that pectins account for less than 50% of this total fiber. Nevertheless, this relatively modest amount of pectins found in whole apples has now been shown to interact with other apple phytonutrients to give us the kind of blood fat lowering effects that would typically be associated with much higher amounts of soluble fiber intake. In recent comparisons with laboratory animals, the blood fat lowering effects of whole apple were shown to be greatly reduced when whole apples were eliminated from the diet and replaced by pectins alone. In summary, it's not fiber alone that explains the cardiovascular benefits of apple, but the interaction of fiber with other phytonutrients in this wonderful fruit. If you want the full cardiovascular benefits of apples, it's the whole food form that you'll want to choose. Only this form can provide you with those unique fiber-plus-phytonutrient combinations.
- The whole food form of apples is also important if you want full satisfaction from eating them. Researchers have recently compared intake of whole apples to intake of applesauce and apple juice, only to discover that people report less hunger (and better satiety, or food satisfaction) after eating whole apples than after eating applesauce or drinking apple juice. But especially interesting was an additional finding about calorie intake following apple consumption. When healthy adults consumed one medium-sized apple approximately 15 minutes before a meal, their caloric intake at that meal decreased by an average of 15%. Since meals in this study averaged 1,240 calories, a reduction of 15% meant a reduction of 186 calories, or about 60 more calories than contained in a medium apple. For these researchers, "getting ahead" in calories with a net reduction of 60 calories was a welcomed outcome of the study, and an extra benefit to their study's primary conclusion—the importance of whole apples (versus other more processed apple forms) in helping us manage our hunger and feeling more satisfied with our food.
- Scientists have recently shown that important health benefits of apples may stem from their impact on bacteria in the digestive tract. In studies on laboratory animals, intake of apples is now known to significantly alter amounts of two bacteria (*Clostridiales* and *Bacteriodes*) in the large intestine. As a result of these bacterial changes, metabolism in the large intestine is also changed, and many of these changes appear to provide health benefits. For example, due to bacterial changes in the large intestine, there appears to be more fuel available to the large intestine cells (in the form of butyric acid) after apple is consumed. We expect to see future studies confirming these results in humans, and we are excited to think about potential health benefits of apple that will be related to its impact on bacterial balance in our digestive tract.

WHFoods Recommendations

Apples belong to the Rose family of plants and are joined in that family by a wide range of very popular foods, including apricots, plums, cherries, peaches, pears, raspberries, and almonds. Foods in the Rose family are simply too diverse in their nutrient value to allow for any one single recommendation about the number of servings that we should consume from this family on a weekly basis. However, when focusing specifically on apples, several anti-cancer studies show daily intake of this fruit to provide better anti-cancer benefits than lesser amounts. So there may be some truth to that old phrase, "An apple a day keeps the doctor away!" Still, we don't recommend that everyone eat one apple on a daily basis, given the wide variety of available fruits and the nutritional uniqueness of each type. But we do recommend that everyone eat at least 2-3 whole fresh fruits per day, or the equivalent of 2-3 cups' worth of fresh fruit. Within this framework, if apples are a type of fruit that you strongly prefer, there would be nothing wrong with consuming one on a daily basis, and you may get some special health benefits by doing so.

Apple, fresh
1.00 medium
(182.00 grams)

Calories: 95
GI: low

Nutrient	DRI/DV
fiber	17%
vitamin C	11%

Health Benefits

Apple's Amazing Polyphenols

In the past five years, no area of apple research has been more dynamic than the area of apple polyphenols. The balance of these phytonutrients in apples is far more unique than many researchers previously suspected. In terms of flavonols, quercetin is the primary phytonutrient found in apples, and it's far more concentrated in the skin than in the pulp. Kaempferol and myricetin are also important apple flavonols. Chlorogenic acid is apple's primary phenolic acid, and it's found throughout the pulp and also in the skin. If apples are red, it's because of their anthocyanins, which are largely restricted to the skin. When an apple is more uniformly red in color, or when its red color is deeper in hue, it's because there are more anthocyanins. In terms of catechin polyphenols, epicatechin is the primary nutrient found in apples. The flavonoid phloridzin accounts for 98% of the flavonoids found in the apple seeds. The total polyphenol contents of apples range from about 1-7 grams/kilogram of fresh pulp, but this ratio gets much higher in the skin, underscoring the special value of apple skins for deriving optimal polyphenol benefits from this fruit. In fact, in animal studies, there is a very commonly used standardized apple extract called standardized apple peel polyphenol extract, or APPE.

You might wonder why apples end up with such an amazing array of polyphenols. In this context, it's fascinating to see that recent research studies show polyphenols to be the favorite mechanism used by apples to protect themselves from UV-B radiation. Cells in the skin of apple that conduct photosynthesis are especially sensitive to UV-B light from the sun. Many of the polyphenols in the skin of apples can actually absorb UV-B light, and thereby prevent UV-B from damaging the photosynthetic cells in the apple skin. Polyphenols, then, are like the apple's natural sunscreen.

It is also interesting to note that the amazing polyphenol content of apples is related to their easy browning when sliced open or bruised. Inside the cells of apple skin and pulp are enzymes called polyphenol oxidases, or PPOs. When the cells of the apple are sliced through or physically damaged when an apple is dropped, the PPOs start oxidizing the polyphenols in apples, and the result you see is a browning of the damaged apple portion. It's important to handle apples delicately in order to protect their health-supportive polyphenols! (Also in this context, it's worth mentioning that damaged apples not only turn brown from the oxidation of their polyphenols, but they also start releasing relatively large amounts of ethylene gas that can pose a risk to other undamaged apples. This phenomenon is why people say that "one bad apple can spoil the whole bunch." Once again, the problem of ethylene gas from apple bruising or other damage underscores the importance of handling this amazing fruit with tender loving care and removing any damaged apples from groups of apples stored in bulk.)

Antioxidant Benefits

Since most of the polyphenols in apples function as antioxidants, it's not surprising to see so many health benefit studies focusing on the antioxidant benefits from apple. Particularly strong is the ability of apples to decrease oxidation of cell membrane fats. This benefit is especially important in our cardiovascular system since oxidation of fat (called lipid peroxidation) in the membranes of cells that line our blood vessels is a primary risk factor for clogging of the arteries (atherosclerosis) and other cardiovascular problems. Apples' strong antioxidant benefits are also related to their ability to lower risk of asthma in numerous studies, and their ability to lower risk of lung cancer. In addition to their unusual polyphenol composition, apples also provides us with about 8 milligrams of vitamin C. While that amount is not a lot, it's still important, especially since the recycling of vitamin C in our body depends on the presence of flavonoids and apples do an amazing job of providing us with those flavonoids.

Cardiovascular Benefits

The cardiovascular benefits of apples are well-documented in research studies, and they are closely associated with two aspects of apple nutrients: their water-soluble fiber (pectin) content, and their unusual mix of polyphenols. Total cholesterol and LDL-cholesterol are both decreased through regular intake of apples. In some studies, "regular intake" has meant apple intake very close to the level of one whole fresh apple per day. As mentioned earlier, the strong antioxidant composition of apples provides us with protection from possible oxidation of fats (called lipid peroxidation), including fats found in the bloodstream (like triglycerides) or fats found in the membranes of cells linking our blood vessels. Decreased lipid peroxidation is a key factor in lowering risk of many chronic heart problems. Recent research has shown that the quercetin content of apples also provides our cardiovascular system with anti-inflammatory benefits. (Our blood levels of C-reactive protein, or CRP, are reduced following consumption of apples and researchers believe that the quercetin content of apples is the primary reason for this drop in CRP.) What a fantastic combination of cardiovascular benefits from such a widely available and delicious fruit!

Benefits for Blood Sugar Regulation

This area of research on apple benefits is relatively new, but it's already awakening the interest of an increasing number of food scientists. At many different levels, the polyphenols in apples are clearly capable of influencing our digestion and absorption of carbohydrates, and the overall impact of these changes is to improve regulation of our blood sugar. The impact of apple polyphenols on our carbohydrate processing includes:

- Slowing down of carbohydrate digestion. Quercetin and other flavonoids found in apples act to inhibit carbohydrate-digesting enzymes like alpha-amylase and alpha-glucosidase. When these enzymes are inhibited, carbohydrates are broken down less readily into simple sugars, and less load is placed on our bloodstream to accommodate more sugar.
- Reduction of glucose absorption. Polyphenols in apples clearly lower the rate of glucose absorption from our digestive tract. Once again, this change lessens the sugar load on our bloodstream.
- Stimulation of the pancreas to put out more insulin. Getting sugar out of our bloodstream often requires the help of insulin, a hormone produced by the beta cells of our pancreas. By telling the beta cells of our pancreas to produce more insulin, the polyphenols found in apple can help us clear more sugar from our blood and keep our blood sugar level in better balance.
- Stimulation of insulin receptors to latch on to more insulin and increase the flow of sugar out of our bloodstream and into our cells. In order for sugar to leave our bloodstream and enter our cells (especially our muscle cells), insulin receptors on those cells must bind together with the insulin hormone and create cell changes that will allow sugar to pass through the cell membrane and into the cell. (Muscle cells, for example, continuously need this uptake of sugar from the bloodstream in order to function.) Polyphenols in apples help to activate the muscle cell insulin receptors, and in this way, they help facilitate passage of sugar from our bloodstream up into our cells. Once again, the result is better blood sugar regulation in our body.

Anti-Cancer Benefits

Although some preliminary results show apple benefits for several different cancer types (especially colon cancer and breast cancer), it's the area of lung cancer benefits that stand out in the apple research. There are numerous studies involving vegetable/fruit intake and risk of lung cancer. The number of subjects in these studies numbers into the high hundreds of thousands. Although many research studies show an impressive ability of overall fruit and/or vegetable intake to lower lung cancer risk, very few individual fruits show up as protective against lung cancer. Except apples! It's really quite remarkable how apples have been one of the few fruits to demonstrate this unique relationship with lung cancer risk reduction. (Interestingly, this same phenomenon has to some extent also been present in research on asthma.) Researchers aren't certain why apples are so closely associated with reduction of lung cancer risk. Their antioxidant and anti-inflammatory benefits are definitely involved here, but they don't fully explain why apples are such a standout in this health benefit area. We look forward to future research that will help shed light on this unique capacity in apples.

Anti-Asthma Benefits

Like the lung cancer benefits of apples, the anti-asthma benefits have been somewhat surprising to health researchers. Multiple studies have shown apple intake to be associated with decreased risk of asthma. However, in some cases, the study findings have been even stronger. In one study, apples showed better risk reduction for asthma than total fruit-plus-vegetable intake combined! (That comparison might seem like a contradiction since fruit-plus-vegetable intake would clearly include apples. But in this particular study, it turned out that apples were not routinely consumed by fruit-plus-vegetable eaters, such that researchers could separate out a small group of study participants who regularly ate apples and could compare this group to other study participants who regularly ate fruits-plus-vegetables but did not include apples among their fruits.) Like the anti-cancer benefits of apples, apples' anti-asthma benefits are definitely associated with the antioxidant and anti-inflammatory nutrients found in this fruit. However, there is very likely to be something else going on as well since apples appear to be a truly standout fruit in this regard.

Other Health Benefits

While not as developed as research in other areas, preliminary health benefits of apples have also been established for several age-related health problems, including macular degeneration of the eye and neurodegenerative problems, including Alzheimer's disease. In animal studies, prevention of bone loss has also been an area of investigation, particularly related to the phloridizin content of apples.

Description

Apples are a crisp, white-fleshed fruit with a red, yellow or green skin. The apple is actually a member of the Rose family, which may seem strange until we remember that roses make rose hips, which are fruits similar to the apple.

Apples have a moderately sweet, refreshing flavor and a tartness that is present to greater or lesser degree depending on the variety. For example, Golden and Red Delicious apples are mild and sweet, while Pippins and Granny Smith apples are notably brisk and tart. Tart apples, which best retain their texture during cooking, are often preferred for cooked desserts like apple pie, while Delicious apples and other sweeter varieties like Braeburn and Fuji apples are usually eaten raw.

History

The apple tree, which originally came from Eastern Europe and southwestern Asia, has spread to most temperate regions of the world. Over the centuries, many hybrids and cultivars have been developed, giving us the 7,000 varieties in the market today.

Apples have long been associated with the biblical story of Adam and Eve, although there is actually no mention that, in fact, the fruit in question was actually an apple. In Norse mythology, apples were given a more positive persona: a magic apple was said to keep people young forever. Apples' most recent appearance in history occurred in the 1800s in the U.S., when Johnny Appleseed—a real person named John Chapman—walked barefoot across an area of 100,000 square miles, planting apple trees that provided food and a livelihood for generations of settlers.

How to Select and Store

Look for firm fruits with rich coloring. Yellow and green apples with a slight blush are best. Your preference for a sweeter or more tart fruit and whether you plan to enjoy your apples raw or cooked will guide your choice of variety. Just remember that Red and Golden Delicious are among the sweetest apples. Braeburn and Fuji apples are slightly tart, and Gravenstein, Pippin, and Granny Smith apples are the most tart, but retain their texture best during cooking.

In the northern hemisphere, apple season begins at the end of summer and lasts until early winter. Apples available at other times have been in cold storage or are imported from the southern hemisphere.

Whole apples are a much better nutritional choice than apple juice. Not only are whole apples richer in dietary fiber, but the current processes of juicing seem to drastically reduce the polyphenolic phytonutrient concentrations originally found in the whole fruit.

Apples can be stored for relatively long (3-4 months) periods of time. Cold storage at low refrigerator temperatures (35-40F/2-4C) is able to help minimize loss of nutrients. In addition, it's helpful to maintain some moisture in the cold storage area, for example, by inclusion of damp cheesecloth in the crisper bin of a refrigerator. Over a period of time involving months, there is loss of total polyphenols from apples, including both flavonoid and non-flavonoid polyphenols. However, valuable amounts of polyphenols (and all other nutrients) remain. In some food traditions, cold storage of apples over the winter months is still counted on as a key part of dietary nourishment from fruits.

You've no doubt heard the saying, "one bad apple can spoil the whole bunch." Well, research studies agree. An apple that has been bruised from being dropped (or that has been damaged in some other way) will start to release unusual amounts of ethylene gas. This ethylene gas can pose a risk to other apples that have not been damaged and greatly decrease their shelf life. For this reason, it's important to handle apples with tender loving care, and also to remove any damaged apples from groups of apples stored in bulk.

How to Enjoy

A few quick serving ideas

- Add diced apples to fruit or green salads.
- Braise a chopped apple with red cabbage.
- Looking for an alternative to sweet desserts? Sliced apples (either alone or with other fruits) and cheese are a European favorite.

WHFoods Recipes That Feature Apples

- 10-Minute Apple Sundae
- 10-Minute Fig and Fresh Apple Cobbler
- Apple Treats
- No-Bake Apple Walnut Tart
- Yogurt with Fruit

Safety

If you do purchase non-organic apples, you may want to ask your grocer about the kind of wax used to protect the apple's surface during storage or shipping. Carnauba wax (from the carnauba palm tree), beeswax, and shellac (from the lac beetle) are preferable to petroleum-based waxes, which contain solvent residues or wood resins.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Apple, fresh **1.00 medium** **182.00 grams**				**Calories: 95** **GI: low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
fiber	4.37 g	17	3.3	good
vitamin C	8.37 mg	11	2.1	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Apricots

Apricots are those beautifully orange colored fruits full of beta-carotene and fiber that are one of the first signs of summer. Although dried and canned apricots are available year-round, fresh apricots with a plentiful supply of vitamin C and are in season in North America from May through August. Any fresh fruit you see during the winter months have been imported from either South America or New Zealand.

Relatives to peaches, apricots are small, golden orange fruits, with velvety skin and flesh, not too juicy but definitely smooth and sweet. Some describe their flavor as almost musky, with a faint tartness that lies somewhere between a peach and a plum.

Apricot, fresh
1.00 whole
(35.00 grams)

Calories: 17
GI: medium

Nutrient	DRI/DV
vitamin C	5%
vitamin A	4%
potassium	3%
copper	3%
fiber	3%

Health Benefits

Apricots are rich in many plant antioxidants. Some of these are the vitamin antioxidants so familiar to regular users of this site. Others are more difficult to obtain from other foods, and may be responsible for specific health benefits. Overall, consider the apricot to be a great food that provides you with the protective effects of antioxidants while adding very few calories to your daily total.

Protection Against Free Radical Damage

Apricots contain a number of potent antioxidants. We rank the apricot as a good source of both vitamin A (from beta-carotene) and vitamin C. The health benefits associated with each are multiple and well-documented.

Apricots are rich in other antioxidants, too, including polyphenolic antioxidants like flavonoids. Diets rich in flavonoids and the other types of polyphenols found in apricots have been linked to reductions in heart disease in humans, as well as other potential health benefits.

Antioxidants are responsible for some of the specific effects listed below, but those only scratch the surface of the potential health benefits of diets rich in these important nutrients. Here are a few of the important antioxidant nutrients or nutrient groups found in apricots:

- Quercetin
- Proanthocyanidins
- Catechins
- Epicatechins
- Hydroxycinnamics
- Gallic acid
- Caffeic acid
- Coumaric acid
- Ferulic acid

Protect Your Eyesight

Apricots are rich in the carotenoids and xanthophylls, nutrients that researchers believe may help protect eyesight from aging-related damage To give an example of how this works, one of these nutrients (lutein) appears to be able to protect the retina—the part of the eye that picks up the visual image from the environment—from damage caused by blue light.

Additionally, researchers have linked regular intake of fruit with less risk of vision loss with aging. This benefit is found in people who eat three or more servings of fruit each day.

Three servings of fruit may sound like a lot to eat each day, but by simply snacking on an apricot, tossing a banana into your morning smoothie, and topping off a cup of yogurt or green salad with one-half cup of berries, you've reached this goal.

Protect Against Inflammation

Apricots are a strong dietary source of catechins, a broad family of flavonoid phytonutrients (you may be familiar with these phytonutrients since they are often cited for the benefits provided by green tea). A single apricot will provide you with 4-5 grams from catechins. These phytonutrients are potent anti-inflammatory nutrients and researchers have looked extensively at their health effects. Researchers have discovered that catechins can inhibit the activity of an enzyme called cyclooxygenase-2 (COX-2), one of the critical steps in the process of inflammation.

Much of this research on catechin benefits involves animal rather than human studies. But we have seen human research where diets rich in catechins—not specifically from apricots but from other catechin-rich foods like tea or cocoa—have led to significant beneficial changes. For instance, multiple studies have shown that catechin-rich foods can protect blood vessels from inflammation-related damage, leading to better blood pressure control.

Other Health Benefits

Apricots are a good source of dietary fiber. This overall fiber content should be helpful for most people in supporting digestive health. Within the total dietary fiber provided by apricots, about half consists of soluble fiber. Soluble fiber is one type of fiber that can help to control blood cholesterol levels.

Description

Apricots are small, golden orange fruits, with velvety skin and flesh: not too juicy but definitely smooth and sweet. Their flavor is almost musky, with a faint tartness that is more pronounced when the fruit is dried. Some people think of the flavor as being somewhere between a peach and a plum, fruits to which they're closely related.

History

Apricots are originally from China but arrived in Europe via Armenia, which is why the scientific name is Prunus armenaica. The apricot tree came to Virginia in 1720 but its appearance in the Spanish missions of California around 1792 marked the fruit's real arrival. The climate there is perfectly suited to apricot culture, and apricots in the United States are grown primarily in the sunny orchards of California.

Apricots are enjoyed as a fresh fruit but also dried, cooked into pastry, and eaten as jam. The fruits are also distilled into brandy and liqueur. Essential oil from the pits is sold commercially as bitter almond oil. Turkey, Italy, Russia, Spain, Greece, U.S.A. and France are the leading producers of apricots.

How to Select and Store

Apricot season in the U.S. runs from May through August. In the winter, apricots are imported from South America. Look for fruits with a rich orange color while avoiding those that are pale and yellow. Fruits should be slightly soft. If they are too firm they have not been tree-ripened, and tree-ripened fruits always taste best. For the most antioxidants, choose fully ripened fruit.

How to Enjoy

A few quick serving ideas:

- Add sliced apricots to hot or cold cereal.
- The next time you make whole grain pancakes add some chopped apricots to the batter.
- Give a Middle Eastern flavor to chicken or vegetable stews with the addition of dried, diced apricots.
- Serve fresh apricots in your green salad when they are in season.

Safety

Dried Apricots and Sulfites

Commercially grown dried apricots may be treated with sulfur-containing compounds during processing to extend their shelf life. For details about possible adverse reactions to sulfites, please see our article An Overview of Adverse Food Reactions

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Apricot, fresh
1.00 whole
35.00 grams

Calories: 17
GI: medium

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin C	3.50 mg	5	5.0	good
vitamin A	33.70 mcg RAE	4	4.0	good
copper	0.03 mg	3	3.6	good
fiber	0.69 g	3	3.0	good
potassium	90.65 mg	3	2.8	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Bananas

Wonderfully sweet with firm and creamy flesh, bananas come prepackaged in their own yellow jackets and are available for harvest throughout the year.

The banana plant grows 10 to 26 feet and belongs to the Musaceae family of plants along with plantains.

The cluster of fruits contain anywhere from 50 to 150 bananas with individual fruits grouped in bunches, known as "hands," containing 10 to 25 bananas.

Banana, fresh
1.00 medium
(118.00 grams)

Calories: 105
GI: low

Nutrient	DRI/DV
vitamin B6	25%
manganese	16%
vitamin C	14%
potassium	12%
fiber	12%
copper	10%
biotin	10%

Health Benefits

Creamy, rich, and sweet, bananas are a favorite food for everyone from infants to elders. They could not be more convenient to enjoy, and they are a good source of both vitamins and minerals, as well as fiber.

Cardiovascular Health

A first type of cardiovascular benefit from bananas is related to their potassium content. Bananas are a good source of potassium, an essential mineral for maintaining normal blood pressure and heart function. Since one medium-sized banana contains a whopping 400-plus mg of potassium, the inclusion of bananas in your routine meal plan may help to prevent high blood pressure and protect against atherosclerosis.

The effectiveness of potassium-rich foods such as bananas in lowering blood pressure has been demonstrated by a number of studies. For example, researchers tracked over 40,000 American male health professionals over four years to determine the effects of diet on blood pressure. Men who ate diets higher in potassium-rich foods, as well as foods high in magnesium and cereal fiber, had a substantially reduced risk of stroke. We've also seen numerous prospective clinical research trials showing substantial reductions of blood pressure in individuals eating the potassium-rich DASH Diet.

A second type of cardiovascular benefit from bananas involves their sterol content. While bananas are a very low-fat food (less than 4% of their calories come from fat), one type of fat that they do contain in small amounts are sterols like sitosterol, campesterol, and stigmasterol. As these sterols look structurally similar to cholesterol, they can block the absorption of dietary cholesterol. By blocking absorption, they help us keep our blood cholesterol levels in check.

A third type of cardiovascular benefit from bananas involves their fiber content. At about 3 grams per medium banana, we rank bananas as a good source of fiber. Approximately one-third of the fiber in bananas is water-soluble fiber. For one medium-sized banana, this amount translates into 1 gram of soluble fiber per banana. Soluble fiber in food is a type of fiber especially associated with decreased risk of heart disease, making regular intake of bananas a potentially helpful approach to lowering your heart disease risk.

Digestive Benefits

Bananas are a fascinating fruit in terms of their carbohydrate and sugar content. Even though bananas are a fruit that tastes quite sweet when ripe—containing 14-15 grams of total sugar—bananas receive a rating of low in their glycemic index (GI) value. GI measures the impact of a food on our blood sugar. This low GI value for bananas is most likely related to two of their carbohydrate-related qualities.

First, as mentioned previously, a medium-size banana contains about 3 grams of total fiber. Fiber is a nutrient that helps regulate the speed of digestion, and by keeping digestion well-regulated, conversion of carbohydrates to simple sugars and release of simple sugars from digesting foods also stays well-regulated.

Within their total fiber content, bananas also contain pectins. Pectins are unique and complicated types of fiber. Some of the components in pectins are water-soluble, and others are not. As bananas ripen, their water-soluble pectins increase, and this increase is one of the key reasons why bananas become softer in texture as they ripen. As their water-soluble pectins increase, so does their relative concentration of fructose in comparison to other sugars. This increase in water-soluble pectins and higher proportional fructose content helps normalize the rate of carbohydrate digestion and moderates the impact of banana consumption on our blood sugar. The bottom line here are some surprisingly digestion-friendly consequences for a fruit that might be casually dismissed as being too high in sugar to be digestion-friendly.

Similar to the importance of their water-soluble pectins is the digestive importance of fructooligosaccharides (FOS) in bananas. FOS are unique fructose-containing carbohydrates that are typically not broken down by enzymes in our digestive tract. Instead, they move along through the digestive tract until they reach our lower intestine and get metabolized by bacteria. This process helps maintain the balance of "friendly" bacteria (for example, *Bifidobacteria*) in our lower intestine, and as a consequence, it also supports our overall digestive health.

In one study involving female participants, eating two bananas each day for two months led to significant increases in *Bifidobacteria*. Along with these increased levels of *Bifidobacteria*, participants also experienced fewer gastrointestinal problems and more regular bowel function when compared to other women in the study who drank a banana-flavored beverage that did not contain any actual banana.

Athletic performance

The unique mix of vitamins, minerals, and low glycemic carbohydrates in bananas has made them a favorite fruit among endurance athletes. Their easy portability, low expense, and great taste also help support their popularity in this exclusive group.

A 2012 study of distance cyclists found that eating the equivalent of about one half a banana every 15 minutes of a three-hour race was just as good at keeping energy levels steady as drinking an equivalent amount of carbohydrate and minerals from a processed sports beverage. Bananas have long been valued by athletes for prevention of muscle cramps. Since bananas are a good source of potassium, and since low potassium levels are known to contribute to risk of muscle cramps, it is logical to think about the potassium content of bananas as being the reason for fewer muscle cramps after consumption of bananas. There is actually some recent research in support of this reasoning. In a recent study, consumption of one or two bananas prior to an hour of exercise was shown to keep blood potassium levels higher after the training. But there are still some big unanswered questions here, since researchers are not convinced that low potassium levels are the most frequent cause of muscle cramps with training.

Description

Bananas are elliptically shaped fruits "prepackaged" by Nature, featuring a firm, creamy flesh gift-wrapped inside a thick inedible peel. The banana plant grows 10 to 26 feet in height and belongs to the family Musaceae. Banana fruits grow in clusters of 50 to 150, with individual fruits grouped in bunches, known as "hands," of 10 to 25 bananas.

Bananas abound in hundreds of edible varieties that fall under two distinct species: the sweet banana (*Musa sapienta*, *Musa nana*) and the plantain banana (*Musa paradisiacal*). Sweet bananas vary in size and color.

While we are accustomed to thinking of sweet bananas as having yellow skins, they can also feature red, pink, purple and black tones when ripe. Their flavor and texture range with some varieties being sweet while others have starchier characteristics. In the United States, the most familiar varieties are Big Michael, Martinique and Cavendish. Plantain bananas are usually cooked and considered more like a vegetable due to their starchier qualities; they have a higher beta-carotene concentration than most sweet bananas.

History

Bananas are thought to have originated in Malaysia around 4,000 years ago. From there, they spread throughout the Philippines and India, where in 327 B.C. Alexander the Great's army recorded them being grown.

Bananas were introduced to Africa by Arabian traders and discovered there in 1482 A.D. by Portuguese explorers who took them to the Americas, the place where the majority of bananas are now produced.

Bananas were not brought to the United States for sale in markets until the latter part of the 19th century and were initially only enjoyed by people in the seacoast towns where the banana schooners docked; because of the fruit's fragility, they were unable to be transported far.

Since the development of refrigeration and rapid transport in the 20th century, bananas have become widely available. Today, bananas grow in most tropical and subtropical regions with the main commercial producers including Costa Rica, Mexico, Ecuador and Brazil.

How to Select and Store

Since bananas are picked off the tree while they're still green, it's not unusual to see them this color in the store. Base your choice of bananas depending upon when you want to consume them. Bananas with more green coloration will take longer to ripen than those more yellow in hue and/or with brown spots.

Bananas should be firm, but not too hard, bright in appearance, and free from bruises or other injuries. Their stems and tips should be intact. The size of the banana does not affect its quality, so simply choose the size that best meets your needs.

While bananas look resilient, they're actually very fragile and care should be taken in their storage. They should be left to ripen at room temperature and should not be subjected to overly hot or cold temperatures. Unripe bananas should not be placed in the refrigerator as this will interrupt the ripening process to such an extent that it will not be able to resume even if the bananas are returned to room temperature.

If you need to hasten the ripening process, you can place bananas in a paper bag or wrap them in newspaper, adding an apple to accelerate the process. Ripe bananas that will not be consumed for a few days can be placed in the refrigerator. While their peel may darken, the flesh will not be affected. For maximum flavor when consuming refrigerated bananas, remove them from the refrigerator and allow them to come back to room temperature. For the most antioxidants, eat fully ripened fruit.

Bananas can also be frozen and will keep for about 2 months. Either puree them before freezing or simply remove the peel and wrap the bananas in plastic wrap. To prevent discoloration, add some lemon juice before freezing.

How to Enjoy

In addition to being eaten raw, bananas are a wonderful addition to a variety of recipes from salads to baked goods.

A few quick serving ideas:

- A peanut butter and banana sandwich drizzled with honey is an all-time favorite comfort food for children and adults alike.
- Add chopped bananas, walnuts and maple syrup to oatmeal or porridge.
- Try our Tropical Breakfast Risotto in the Recipe File.

Safety

Bananas and Latex-Fruit Syndrome

Latex-fruit syndrom is a health problem related to the possible reaction of our immune system to certain proteins found in natural rubber (from the tree *Hevea brasiliensis*) and highly similar proteins found in certain foods, such as bananas. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Banana, fresh **1.00 medium** **118.00 grams**				**Calories: 105** **GI: low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin B6	0.43 mg	25	4.3	very good
manganese	0.32 mg	16	2.7	good
vitamin C	10.27 mg	14	2.3	good
fiber	3.07 g	12	2.1	good
potassium	422.44 mg	12	2.1	good
biotin	3.07 mcg	10	1.8	good
copper	0.09 mg	10	1.7	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Blueberries

In terms of U.S. fruit consumption, blueberries rank only second to strawberries in popularity of berries. Blueberries are not only popular, but also repeatedly ranked in the U.S. diet as having one of the highest antioxidant capacities among all fruits, vegetables, spices and seasonings. Antioxidants are essential to optimizing health by helping to combat the free radicals that can damage cellular structures as well as DNA. We recommend enjoying raw blueberries — rather than relying upon blueberries incorporated into baked desserts — because, like other fruits, raw blueberries provide you with the best flavor and the greatest nutritional benefits.

As one of the few fruits native to North America, blueberries have been enjoyed by Native Americans for hundreds of years. They have also enjoyed great popularity around the world in cuisines from Asia to the Mediterranean. For more on the Healthiest Way of Preparing Blueberries, see below.

What's New and Beneficial About Blueberries

- After many years of research on blueberry antioxidants and their potential benefits for the nervous system and for brain health, there is exciting new evidence that blueberries can improve memory. In a study involving older adults (with an average age of 76 years), 12 weeks of daily blueberry consumption was enough to improve scores on two different tests of cognitive function including memory. While participants in the study consumed blueberries in the form of juice, three-quarters of a pound of blueberries were used to make each cup of juice. As participants consumed between 2 to 2-1/2 cups each day, the participants actually received a very plentiful amount of berries. The authors of this study were encouraged by the results and suggested that blueberries might turn out to be beneficial not only for improvement of memory, but for slowing down or postponing the onset of other cognitive problems frequently associated with aging.
- New studies make it clear that we can freeze blueberries without doing damage to their delicate anthocyanin antioxidants. There's no question about the delicate nature of many antioxidant nutrients found in blueberries. These antioxidants include many different types of anthocyanins, the colorful pigments that give many foods their wonderful shades of blue, purple, and red. After freezing blueberries at temperatures of 0°F (-17°C) or lower for periods of time between 3-6 months, researchers have discovered no significant lowering of overall antioxidant capacity or anthocyanin concentrations. Anthocyanins studied have included malvidins, delphinidins, pelargonidins, cyanidins, and peonidins. These findings are great news for anyone who grows, buys, or picks fresh berries in season and wants to enjoy them year round. They are also great news for anyone who has restricted access to fresh blueberries but can find them in the freezer section of the market.
- Berries in general are considered low in terms of their glycemic index (GI). GI is a common way of identifying the potential impact of a food on our blood sugar level once we've consumed and digested that food. In general, foods with a GI of 50 or below are considered "low" in terms of their glycemic index value. When compared to other berries, blueberries are not particularly low in terms of their GI. Studies show the GI for blueberries as falling somewhere in the range of 40-53, with berries like blackberries, raspberries, and strawberries repeatedly scoring closer to 30 than to 40. However, a recent study that included blueberries as a low-GI fruit has found that blueberries, along with other berries, clearly have a favorable impact on blood sugar regulation in persons already diagnosed with type 2 diabetes. Participants in the study who consumed at last 3 servings of low-GI fruits per day (including blueberries) saw significant improvement in their regulation of blood sugar over a three-month period of time. (Their blood levels of glycosylated hemoglobin, or HgA1C were used as the standard of measurement in this study.) It's great to see blueberries providing these clear health benefits for blood sugar regulation!
- If you want to maximize your antioxidant benefits from blueberries, go organic! A recent study has directly compared the total antioxidant capacity of organically grown versus non-organically grown highbush blueberries (*Vaccinium corymbosum L.*, var. Bluecrop) and found some very impressive results for the organically grown berries. Organically grown blueberries turned out to have significantly higher concentrations of total phenol antioxidants and total anthocyanin antioxidants than conventionally grown blueberries, as well as significantly higher total antioxidant capacity. Numerous specific antioxidant anthocyanins were measured in the study, including delphinidins, malvidins, and petunidins. The antioxidant flavonoid quercetin was also measured.

WHFoods Recommendations

In our Healthiest Way of Eating Plan, we encourage the consumption of 5-10 servings of fruits-plus-vegetables (combined) each day. We believe that the balance between fruits and vegetables can vary from day to day, depending upon personal health factors, personal taste preferences, and optimal combining of foods in recipes as well as meals.

We recognize that our recommendation calls for a more generous amount of fruits and vegetables than the amount recommended by the Centers for Disease Control (CDC) at the U.S. Department of Health and Human Services (DHHS). The CDC recommends between 1.5-2.5 cups of fruit and 2.5-4.0 cups of vegetables per day, as well as a target goal of at least 5 fruit-plus-vegetable servings (combined) per day. We recommend that you set your fruit goals higher than these CDC amounts.

Based on the scientific research, we believe it's going to take closer to 3 fruit servings per day (consisting of one cup's worth of fruit per serving, or 3 cups total per day) to provide you with optimum health benefits. With respect to berries in particular, we recommend that you include berries at least 3-4 times per week within your fruit servings. In several of our sample meal plans, we include berries on a daily basis! It would definitely not be a mistake for you to include a serving of berries in your daily meal plan! With respect to blueberries in particular, you might be surprised about the number of blueberries that can fit into a single cup. The average weight for a small, lowbush blueberry (also sometimes called a "wild blueberry") can be close to 1-2 grams, meaning that a weighted cup's worth of wild blueberries will contain 100-150 berries!

Blueberries, fresh
1.00 cup
(148.00 grams)

Calories: 84
GI: low

Nutrient	DRI/DV
vitamin K	32%
manganese	25%
vitamin C	19%
fiber	14%
copper	9%

Health Benefits

In the popular press, blueberries have reached superstar status in terms of their unique health benefits. While we prefer to think of all the World's Healthiest Foods as rightful superstars, we can understand many of the special accolades being given to this wonderful berry. Most health research on blueberries involves their phytonutrient content. Anthocyanins - the colorful antioxidant pigments that give many foods their wonderful shades of blue, purple, and red - are usually the first phytonutrients to be mentioned in descriptions of blueberries and their amazing health-supportive properties. While it is true anthocyanins are pretty spectacular when it comes to blueberries and their support of our body systems, there are actually a wide variety of health support phytonutrients found in blueberries. Here is list that spotlights some of the better studied of these blueberry phytonutrients:

BLUEBERRY PHYTONUTRIENTS

- Anthocyanins
    - malvidins
    - delphinidins
    - pelargonidins
    - cyanidins
    - peonidins
- Hydroxycinnamic acids
    - caffeic acids
    - ferulic acids
    - coumaric acids
- Hydroxybenzoic acids
    - gallic acids
    - procatchuic acids
- Flavonols
    - kaempferol
    - quercetin
    - myricetin
- Other phenol-related phytonutrients
    - pterostilbene
    - resveratrol

Virtually all of the above-named phytonutrients function both as antioxidants and as anti-inflammatory compounds in the body, and they are responsible for many of the well-documented health benefits we get from regular consumption of blueberries.

Whole Body Antioxidant Support

Given the wide variety of antioxidant nutrients present in blueberries, it is not surprising to find research studies showing improved antioxidant defenses in body systems that need special protection from oxidative stress, like the cardiovascular system. But what is surprising about the blueberry research is its whole body relevance. It is not only the cardiovascular system that has been shown to have strengthened antioxidant status following consumption of blueberries. It is virtually every body system studied to date! For example, there is new evidence that damage to muscles following overly taxing exercise can be reduced through consumption of blueberries. There is also evidence that protection of the nervous system from oxidative stress can be accomplished by regular consumption of blueberries. These antioxidant-based protective effects have been shown in older adults at risk of neurodegenerative diseases, as well as in younger healthy adults and middle-aged obese adults. Antioxidant protection of the blood sugar regulatory system has also been demonstrated in blueberry intake studies, as has antioxidant protection of the digestive tract (especially with respect to the colon and its risk of cancer). It's this whole body antioxidant support that helps blueberries stand out as an amazing antioxidant fruit.

Cardiovascular Benefits

Blueberry support of antioxidant defenses has been especially well documented with respect to the cardiovascular system. It's the many different pathways for cardio support that are so striking in the blueberry research. In repeated studies of blood composition, blueberry intake (usually in the amount of 1-2 cups per day and over the course of 1-3 months) has been shown to improve blood fat balances, including reduction in total cholesterol, raising of HDL cholesterol, and lowering of triglycerides. At the same time, blueberry intake has been shown to help protect the blood components (like LDL cholesterol) from oxygen damage that could lead to eventual clogging of the blood vessels. Protection has also been shown for the cells lining the blood vessel walls. Connected with this antioxidant protection of blood vessel structures and blood fats is an improved overall antioxidant capacity in the blood itself. Interestingly, the ability of blueberries to increase plasma antioxidant capacity seems to continue as blueberry intake goes up above everyday levels. For example, some studies have shown better total antioxidant capacity when 3 or more cups of blueberries were consumed per day as compared to a daily intake of 1-2 cups.

Recent research has added yet another factor to our understanding of blueberries and cardioprotection. That factor involves an enzyme called nitric oxide synthase (NOS). Most studies on NOS have focused on a form of NOS called inducible NOS, or iNOS. Excess formation of iNOS is generally associated with increased risk of inflammation. However, there is a second form of NOS called endogenous NOS, or eNOS. Increased activity of eNOS is usually associated with *better* balance in cardiovascular function. Recent studies have shown that daily blueberry intake can result in increased eNOS activity, and this result is viewed as helping to explain some of the unique health benefits of blueberries for the cardiovascular system.

It would be wrong to end a discussion of blueberries and cardiovascular health without talking about blood pressure. In both men and women, and in study participants of many different ages, routine blueberry intake has been shown to support healthy blood pressure. In individuals with high blood pressure, blueberry intake has significantly reduced both systolic and diastolic blood pressures . In individuals with health blood pressure, blueberry intake has been shown to help maintain these healthy pressures.

Cognitive Benefits

One of the most exciting new areas of research on blueberries is the area of cognitive benefits. In one study involving older adults (with an average age of 76 years), 12 weeks of daily blueberry consumption was enough to improve scores on two different tests of cognitive function including memory. While participants in the study consumed blueberries in the form of juice, three-quarters of a pound of blueberries were used to make each cup of juice. As participants consumed between 2 and 2-1/2 cups per day, they actually received a very plentiful amount of berries. The authors of this study were encouraged by the results and suggested that blueberries might turn out to be beneficial not only for improvement of memory, but for slowing down or postponing the onset of other cognitive problems frequently associated with aging.

Lab and animal research studies on blueberry intake suggest that a large part of this cognitive protection is most likely due to nerve cell protection from oxygen damage by blueberries' vast array of antioxidant nutrients. Nerve cells have a naturally high risk of oxygen damage and they require special antioxidant protection at all times in life. Their ability to send information throughout the body depends on the presence of balanced oxygen metabolism, and that balance cannot be achieved without ample intake of antioxidant nutrients. By lowering the risk of oxidative stress in our nerve cells, blueberries help us maintain smoothly working nerve cells and healthy cognitive function.

Blood Sugar Benefits

Persons diagnosed with type 2 diabetes, metabolic syndrome, and insulin resistance have a special challenge with respect to blood sugar balance. In many cases, persons diagnosed with obesity also have special challenge maintaining a balanced blood sugar level. It's simply more difficult for these individuals to keep their blood sugar levels from spiking too high (or sometimes also from dropping down too low). Research on blood sugar balance and blueberry intake has been conducted on individuals who have been diagnosed with type 2 diabetes, metabolic syndrome, or insulin resistance, and the results of this research have been consistent. They have shown that blueberries (along with other berries) have a favorable impact on blood sugar regulation in persons already diagnosed with blood sugar problems.

When compared to other berries, blueberries are not particularly low in terms of their glycemic index (GI) value. Studies show the GI for blueberries falling somewhere in the range of 40-53, with berries like blackberries, raspberries, and strawberries repeatedly scoring closer to 30 than to 40. However, recent studies have shown that blueberries definitely function as a low-GI fruit in terms of their blood sugar impact. In one study on individuals diagnosed with type 2 diabetes, study participants who consumed at last 3 servings of low-GI fruits per day (including blueberries) saw significant improvement in their regulation of blood sugar over a three-month period of time. Their blood levels of glycosylated hmmoglobin, or HgA1C were used as the standard of measurement in this study.

The blood sugar benefits of blueberries should not be surprising. Even at 40-53 in terms of glycemic index, blueberries typically fall into the "low-GI" category of foods (usually defined as any food with a GI of 50 or below). They also provide a very good amount of fiber (nearly 4 grams per cup). Most low-GI foods with strong fiber content are foods we can count on to be helpful in blood sugar regulation.

Eye Health

The retina of the eye is a unique place in our body and it is also a place that is at higher than normal risk of oxidative stress. Foods unique in phytonutrient antioxidants are often investigated for their ability to help protect the retina from oxygen damage, and blueberries are no exception! In preliminary studies on laboratory animals, the anthocyanins in blueberry protected the retina from unwanted oxygen damage. Interestingly, they have also been determined to help protect the retina from damage from sunlight. Like the area of cancer protection, we look forward to future research on human eye health and the potential for blueberry intake to help protect the human eye from damage by sunlight and oxidative stress.

Anti-cancer Benefits

While almost exclusively coming in the form of laboratory studies on human cells or laboratory animal studies, an increasing percentage of the blueberry research is being focused on anti-cancer benefits. Types of cancer already studied with respect to blueberry intake include breast cancer, colon cancer, esophageal cancer, and cancers of the small intestine. We look forward to the results of large-scale human studies on the potential ability of blueberry intake to lower risk of these cancer types.

Description

With flavors that range from mildly sweet (cultivated) to tart and tangy (wild), blueberries are nutritional stars bursting with nutrition and flavor while being very low in calories.

Blueberries are the fruits of a shrub that belong to the heath (*Ericaceae*) family whose other members include the cranberry and bilberry as well as the azalea, mountain laurel, and rhododendron. Blueberries grow in clusters and range in size from that of a small pea to a marble. They are deep in color, ranging from blue to maroon to purple-black, and feature a white-gray waxy "bloom" that covers the berry's surface and serves as a protective coat. The skin surrounds a semi-transparent flesh that encases tiny seeds. Blueberries are at their best from May through October when they are in season.

From a botanical perspective, all blueberries belong not only to the *Ericaceae* family of plants but also to the *Vaccinium* genus. Within this Vaccinium genus, however, are three very interesting groups of blueberries!

- **Highbush Blueberries**: These species are the most commonly cultivated forms of blueberries and the type we see most often in the grocery store. Included here are northern and southern highbush, which can grow as high as 12 feet in height in their native (uncultivated) state but when cultivated usually stay within a range of 4-7 feet. Highbush blueberries are also the kind you're most likely to find available for purchase at your local garden stores and plant nurseries. Cultivated highbush blueberries have often been hybridized to produce larger size berries, which U.S. consumers seem to prefer.
- **Lowbush Blueberries**: These species are commonly referred to as "wild blueberries." In their native state, they typically grow less than 2 feet in height and often stay even lower, at 8-12 inches from the ground. Lowbush species produce berries of a smaller size than highbush and even though they can be found growing wild in many parts of the U.S. are not commonly found in supermarkets.

- **Rabbiteye Blueberries**: These species are native to the southern U.S. and can grow up to 20 feet in height in their native state. They are less frequently cultivated than highbush blueberries, but when cultivated, the plant usually grows to heights of 4-10 feet.

All types of blueberries described above have found their way into agricultural practices around the world and are part of cuisines from Asia to the Mediterranean. Some varieties were originally transported to Europe and Asia from North America, but native varieties of blueberries can be found on all three continents.

History

Blueberries hold a special place in the foods of North America, since more species of blueberries are native to North America than any other continent. While lowbush berries are native to other parts of the world — including Europe, the Mediterranean and Asia — highbush berries were originally found almost exclusively in North America. To this day, the United States cultivates and supplies over half of all blueberries on a global basis. (The next largest percentage of world production — about 30% — also belongs to a North American country, Canada.) Among the 275 million pounds of blueberries grown in the U.S. (out of 550 million pounds grown worldwide), Maine, Michigan, New Jersey, Oregon, and North Carolina are states most heavily involved in blueberry farming. Because of its special interest in lowbush blueberries, the state of Maine is actually the largest lowbush blueberry producer in the world.

Cultivation of blueberries was widespread among the Native American tribes throughout North America. European colonists learned about blueberries thanks to these Native American traditions and brought blueberry species back to Europe. Yet commercial cultivation of blueberries in Europe has been a relatively recent phenomenon limited to the 20th and 21st centuries. Thanks to increasing cultivation in the Southern Hemisphere — including South American countries such as Chile, Argentina, and Uruguay as well South Africa, New Zealand and Australia — fresh blueberries are now enjoyed throughout the year on many of the world's continents.

One interesting current trend in history of blueberries has been their dramatically increased consumption within the U.S. In 1997, the average U.S. adult consumed about 13 ounces of blueberries per year. Ten years later, in 2007, that amount nearly doubled and reached an average level of 22 ounces. This increasing consumption of blueberries within the U.S. has led to cultivation of blueberries on almost 100,000 acres of land in the U.S., and has moved blueberries to second place as the most commonly eaten berry in the U.S. (second only to strawberry).

How to Select and Store

Choose blueberries that are firm and have a lively, uniform hue colored with a whitish bloom. Shake the container, noticing whether the berries have the tendency to move freely; if they do not, this may indicate that they are soft and damaged or moldy. Avoid berries that appear dull in color or are soft and watery in texture. They should be free from moisture since the presence of water will cause the berries to decay. When purchasing frozen berries, shake the bag gently to ensure that the berries move freely and are not clumped together, which may suggest that they have been thawed and refrozen. Blueberries that are cultivated in the United States are available from May through October while imported berries may be found at other times of the year.

Before storing remove any crushed or moldy berries to prevent the rest from spoiling. Don't wash berries until right before eating as washing will remove the bloom that protects the berries' skins from degradation. Store ripe blueberries in a covered container in the refrigerator where they will keep for up to 3 days. If kept out at room temperature for more than a day, the berries may spoil.

Ripe berries can also be frozen, although this will slightly change their texture and flavor. Before freezing, wash, drain and remove any damaged berries. To better ensure uniform texture upon thawing, spread the berries out on a cookie sheet or baking pan, place in the freezer until frozen, then put the berries in a plastic bag for storage in the freezer.

Recent research has shown that fresh blueberries can be frozen without damaging their delicate anthocyanin antioxidants. There's no question about the delicate nature of many antioxidant nutrients found in blueberries. These antioxidants include many different types of anthocyanins, the colorful pigments that give many foods their wonderful shades of blue, purple, and red. After freezing blueberries at temperatures of 0°F (-17°C) or lower for periods of time between 3-6 months, researchers have discovered no significant lowering of overall antioxidant capacity or anthocyanin concentrations. Anthocyanins studied have included malvidins, delphinidins, pelargonidins, cyanidins, and peonidins. These findings should encourage you to consider freezing your blueberries if you have an abundant seasonal supply but restricted access to fresh berries during other parts of the year.

How to Enjoy

A Few Quick Serving Ideas

- Add frozen blueberries to your breakfast shake. If the blender container is plastic, allow berries a few minutes to soften, so they will not damage the blender.
- Fresh or dried blueberries add a colorful punch to cold breakfast cereals.
- For a deliciously elegant dessert, layer yogurt and blueberries in wine glasses and top with crystallized ginger.

WHFoods Recipes That Feature Blueberries

- Granola with Fresh Fruit
- Healthy High Fiber Cereal
- Quinoa Cereal with Fresh Fruit
- Yogurt with Fruit
- Blueberries with Cashew Sauce
- Blueberries with Yogurt and Chocolate
- Blueberry Parfait
- Blueberry Peach Crisp
- Blueberry Trifle
- Fresh Peaches with Blueberries & Yogurt

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Blueberries, fresh **1.00 cup** **148.00 grams**				**Calories: 84** **GI:** low
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin K	28.56 mcg	32	6.8	very good
manganese	0.50 mg	25	5.3	very good
vitamin C	14.36 mg	19	4.1	very good
fiber	3.55 g	14	3.0	good
copper	0.08 mg	9	1.9	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Cantaloupe

What's New and Beneficial About Cantaloupe

- Because the flesh of the cantaloupe is often pastel-like in color (compared to the more vibrant color of fruits like oranges), we sometimes forget how important cantaloupe can be as a fruit source of vitamin A (in the form of carotenoids). Researchers have recently measured the carotenoid contents of six different California-grown cantaloupe hybrids and discovered that their beta-carotene content can reach levels as high as 3,138 micrograms (per 100 grams of fresh weight). That's about 30 times higher than the beta-carotene content of fresh oranges. Although this nutrient richness of cantaloupe still does not place it in the beta-carotene range for fresh carrots here (about 8,300 micrograms), it's still an aspect of this delicious fruit that is all-too-frequently overlooked.
- At first, we were disappointed in the outcome of a recent French study that put cantaloupe at the very bottom of the fruits list in terms of its polyphenol content. In this French study, fruits like strawberries, lychees, and grapes came out far better in their concentration of antioxidant polyphenols than cantaloupe, and no fruit scored lower in its concentration of polyphenols. But then we read about the total amount of polyphenols that cantaloupe contributed to the average daily diet. When looked at in this practical context, cantaloupe ranked higher than many other commonly eaten fruits, including kiwi, grapefruit, and clementines. It also ranked higher than watermelon and pineapple. Obviously, the higher volume of cantaloupe consumed helped to offset its lower polyphenol concentration. This practical principle is important to remember. A health-supportive, whole food like fresh cantaloupe may show up as being lower in its concentration of certain nutrients (including total polyphenols), but because we often eat it in serving sizes that are relatively large, we often get substantial nutrient benefits, even in the case of nutrients found in lower concentrations.
- Intake of cantaloupe has recently been found to lower risk of metabolic syndrome. In a study involving hundreds of women living and teaching in Tehran, Iran, the lowest risk of metabolic syndrome was found to occur in women who ate the greatest amount of fruit. (In this study, the "greatest amount" meant a minimum of 12 ounces per day.) Five fruits contributed most to total fruit intake: apples, grapes, cantaloupe, watermelon, and bananas. Women who consumed the largest amounts of these fruits were also determined to have the healthiest levels of C-reactive protein (CRP) in their bloodstream. CRP is an indicator very commonly used to assess levels of inflammation, and it's very likely that the anti-inflammatory phytonutrients in cantaloupe and other fruits contributed not only to these participants' healthy levels of CRP but also to their decreased risk of metabolic syndrome.

Cantaloupe, cubed, fresh
1.00 cup
(160.00 grams)

Calories: 54
GI: medium

Nutrient	DRI/DV
vitamin C	78%
vitamin A	30%
potassium	12%
copper	8%
folate	8%
vitamin B6	7%
vitamin B3	7%
vitamin B1	6%
magnesium	5%
fiber	5%
vitamin K	4%

Health Benefits

Nutrient Diversity

We seldom think about fruits as providing a broad spectrum of nutrients. In addition, when this food group gets placed in the nutritional spotlight, it's usually berries that get first mention among the nutritional standouts. Yet judging from its nutrient profile, cantaloupe is a fruit that should get us thinking differently about fruit and nourishment. This member of the melon family receives 10 rankings in our food rating system—the same number as raspberries, 1 more than strawberries, and 6 more than blueberries. Cantaloupe scores an "excellent" for both vitamin C and vitamin A (in the form of carotenoids). It scores "very good" for potassium, and "good" for a host of B vitamins (B1, B3, B6, and folate) as well as vitamin K, magnesium, and fiber. When the edible seeds of the cantaloupe are eaten, this melon also provides a measurable about of omega-3 fat in the form of alpha-linolenic acid.

Cantaloupe contains more beta-carotene than alpha-carotene. But because it contains both of these carotenoids, it also contains both of their derivatives, including lutein in the case of alpha-carotene and beta-cryptoxanthin and zeaxanthin in the case of beta-carotene. These carotenoid phytonutrients are joined by the flavonoid luteolin, antioxidant organic acids including ferulic and caffeic acid, and anti-inflammatory cucurbitacins, including cucurbitacin B and cucurbitacin E. The nutrient diversity of cantaloupe is perhaps its most overlooked health benefit!

Antioxidant and Anti-Inflammatory Support

As evidenced by the preceding list of phytonutrients, cantaloupe's nutritional strong suit involves its antioxidant and anti-inflammatory nutrients. Even while it is relatively low in concentration of certain nutrients (like total polyphenols) in comparison to other fruits, cantaloupe still provides us with important amounts because we tend to eat it in larger serving sizes than other fruits.

Many researchers understand metabolic syndrome—a group of health problems that includes high blood fats, high blood sugars, high blood pressure, and too much body fat—to be caused by problems in lifestyle that result in chronic underlying levels of unwanted inflammation and oxidative stress throughout the body. In this context, it's not surprising to see decreased risk of metabolic syndrome in individuals with especially high intake of cantaloupe (along with other fruits), since cantaloupe provides a wide range of antioxidants that help prevent oxidative stress and a wide range of anti-inflammatory phytonutrients that help prevent excessive inflammation. It's also not surprising to see lower levels of C-reactive protein (CRP) in the bloodstream of persons who have particularly high intake of cantaloupe, since CRP is a marker widely used to assess levels of inflammation in the body. One final important note: in the study that documented these benefits of cantaloupe for prevention of metabolic syndrome, "high" intake meant at least 12 ounces of total fruit per day. Since cantaloupe was one of five fruits making a special contribution to these 12 ounces, we assume that few of the study participants would go one whole week without consuming cantaloupe. That approach might help all of us increase our protection from unwanted inflammation and oxidative stress.

Other Health Benefits

Unfortunately, most of the other studies that we have seen on the health benefits of cantaloupe are studies conducted on animals rather than humans. This aspect of the research limits our certainty about the health benefits for humans. However, especially promising in the animal research has been studies related to diabetes. Researchers have shown that intake of cantaloupe phytonutrients can improve insulin and blood sugar metabolism. In addition, intake of cantaloupe extracts has been show to reduce oxidative stress in the kidneys of animals with diabetes, and to improve insulin resistance in diabetic animals.

Given the benefits of cantaloupe for prevention of metabolic syndrome, we would expect to see future studies showing clear health benefits for this melon in the area of heart disease, including atherosclerosis. Many heart-related problems start out with chronic unwanted inflammation and chronic oxidative stress. Hopefully, it won't be long before we have large-scale human studies documenting benefits in this important area.

Description

The fruit widely known as "cantaloupe" throughout the U.S. is actually muskmelon. When we purchase "cantaloupe" in a U.S. grocery store, what we're used to seeing is an outer surface that consists of "netting"—an orderly mosaic pattern - that sits atop and covers the outermost skin (rind). We may or may not also see "ribbing" on the cantaloupe ("ribbing" in the sense of lines running from one end of the cantaloupe to the other, like the seams on a basketball). But if we do see ribbing, it is not usually very heavy or very deep., Melons with a very developed and orderly netting and only mild-to-moderate ribbing are not true cantaloupes but rather muskmelons (*Cucumis melo* var *reticulatus*).

Cantaloupes (*Cucumis melo* var *cantalupensis*) typically lack an extensive, orderly netting and they have ribs (also called "sutures") that are much heavier and more deeply grooved. In addition, true cantaloupes are grown almost exclusively in other parts of the world (and especially in the Mediterranean region). In fact, the name "cantaloupe" actually comes from the name of a town in Italy near Rome called Cantaloupo in Sabina, where seeds were brought from Armenia and planted in the Papal gardens during the 1400-1500's.) Despite this misnaming of "cantaloupes" in the U.S. marketplace however, from hereon we're going to stick with this common U.S. practice and refer to muskmelons as cantaloupes.

Cantaloupes are members of the cucurbit family of plants (*Cucurbitaceae*) that also includes cucumbers, pumpkins, squashes, gourds, and a long list of melons. Melons in this same plant family with cantaloupe include Watermelon and honeydew melon, along with crenshaw, casaba, Persian, and canary melon. Because many members of the cucurbit plant family can easily cross-pollinate, there are also many different hybrid melons in the marketplace that combine features of true cantaloupe with features of these other melons.

The ripe flesh of a cantaloupe can vary in color depending on the hybrid. "Jenny Linds" are one example of a green-fleshed hybrid; "Athena" and "Ambrosia" hybrids have salmon-colored flesh; and the flesh of the Gurney's (TM) hybrids typically has a rich orange color. Cantaloupes have a hollow cavity in their center that is filled with edible seeds. In some parts of the world, cantaloupes are known as "rockmelons."

If you read about cantaloupe across the Internet, you may find a good bit of inconsistency involving the language used to describe the parts of this fruit. Some websites use the words "top" and "bottom" when describing cantaloupes. Other websites use "stem end" and "blossom end." Still others use "vine end" and "end opposite the vine end." As such, we wanted to clarify this topic.

When a plant flowers, no fruit forms until pollination (either self pollination or preferably cross pollination). Once pollination has occurred, fruit can begin to form. As the fruit forms, the flower will fall away. The spot where the flower was will become one end of the fruit, and it is called the blossom end. The stem end, of course, will be the end where the fruit remains connected to the plant. If the fruit is an apple, its weight and relationship to the tree branch will typically cause it to hang down from the branch, creating two ends that are truly "top" and "bottom."

But with a fruit like a cantaloupe which sits on the ground, the vine will typically lie alongside of the fruit in such a way that the ends would be more logically described as being on the sides of the cantaloupe, rather on its top and its bottom. Still, the word "top" is sometimes used to refer to the stem end of a cantaloupe, and the word "bottom" is sometimes used to refer to the blossom end.

History

Historians aren't certain about the exact origins of cantaloupe. The large number of melon family members (*Cucumis melo*) growing wild in Africa has led some investigators to place cantaloupe's origins on that continent. But African melons may *themselves* have had ancestors in parts of Asia, including India or China.

Countries in the northernmost part of Africa lie along the south shores of the Mediterranean Sea, and cantaloupe was also enjoyed by people living in the Mediterranean and Middle East region fairly early on in its history. To this day, and on an annual basis, Turkey (3.5 billion pounds), Iran (2.9 billion pounds), and Egypt (2.4 billion pounds) remain major producers of cantaloupe. (The United States follows after Egypt with 2.2 billion pounds of production.) But in first place - and far ahead of these four countries - is China, a country that now produces half of the world's melons (including cantaloupe) at a volume of nearly 25 billion pounds per year.

Attesting to the worldwide popularity of cantaloupe (and melons in general) is the practice of drying cantaloupe seeds for consumption as a snack food. This tradition can be seen in many parts of Central and South America, as well as in Asia and the Middle East.

Within the U.S., California is the largest cantaloupe-producing state and grows over half of all U.S. cantaloupe. Rounding out the top six cantaloupe-producing states are Arizona, Colorado, Georgia, Indiana, and Texas.

Within California, the bulk of cantaloupe production occurs in one of two regions: the San Joaquin Valley of Central California and the Imperial Valley (in the more desert-like southeastern part of the state). In Imperial Valley, spring season melon planting can begin as early as January, allowing for harvest in May, and fall season planting can take place in July, allowing for harvest in October and November.

Despite its own robust cultivation of cantaloupe, the U.S. continues to import cantaloupe in large amounts. In 2010, the U.S. purchased over 425 million pounds of cantaloupe from Guatemala, nearly 300 million from Honduras, over 150 million from Costa Rica, and more than 60 million from Mexico.

How to Select and Store

The key to purchasing a good quality melon is to find one that is ripe, which is sometimes a challenge because oftentimes they are picked while still unripe in order to ensure that they make it through the shipping process undamaged. There are many clues that you can look for to find a melon that is ripe. The first is by simply picking it up and feeling its weight. Does it feel fuller and heavier than you would expect it to? If so, that's a good thing, because it's an indication of the cantaloupe's ripeness.

Next, tap on the cantaloupe and listen to the sound it makes. If the sound is dull and also deep, that's another indication that you're holding a ripe cantaloupe. But if the sound is higher and hollow, your cantaloupe is probably not ripe.

If you press gently on the top of a ripe cantaloupe (the stem end, where the vine was attached) with your thumb, you should feel it give way very slightly. If that spot gives way substantially, to the point of feeling genuinely soft or even squishy, the cantaloupe is probably overripe. A quick check around different areas of the cantaloupe is also a good idea at this point so you can make sure that there is no bruising or damage.

The appearance of a ripe versus unripe cantaloupe is also different. The rind of a ripe cantaloupe (meaning the outermost layer beneath the netting) is typically going to be cream-colored or yellow or golden but not green or gray. The rind of an unripe cantaloupe is more likely to contain some green or gray. (Don't rely too heavily on this ripeness indicator, however, since some varieties of cantaloupe have rinds that stay green or gray.)

Smelling the bottom of the cantaloupe (also called the blossom end, opposite from the stem end where the vine was attached) can also be helpful in determining its ripeness. Unripe cantaloupes are likely to have a very faint smell, or no smell at all. Ripe cantaloupes are likely to have that spectacular cantaloupe aroma—but not in an overpowering way. If the fragrance is overly strong, the cantaloupe may be overripe.

Once you've found a cantaloupe that gives every indication of being optimally ripe, your next decisions will involve storage. When you get home, place your optimally ripe cantaloupe immediately in the refrigerator, ideally in a crisper bin where there is usually slightly higher humidity. The temperature range of 36-41F (2.2-5C) is best for storing whole ripe cantaloupe. About three to four days is the maximum amount of time that you'll want to store whole ripe cantaloupe under these refrigerator conditions. If you decide to purchase an unripe cantaloupe, it's okay to leave it out at room temperature (non-refrigerated) for a couple of days to allow the texture of its flesh to become softer and juicier. However, it is very important to note that cantaloupe can be left at room temperature only if it is whole, intact, and not yet to the stage of full ripeness. Once the cantaloupe has reached its peak ripeness, refrigeration is mandatory. Regardless of whether a cantaloupe is ripe or unripe, it should not be washed as long as it remains whole and uncut. No matter how well you pat a cantaloupe dry after washing it, the surface of the cantaloupe will absorb moisture during washing and there will be added moisture on the surface of the cantaloupe. This added moisture will increase the likelihood of mold formation and decrease the cantaloupe's shelf life. If you wait and wash your whole cantaloupe just prior to cutting, you'll be consuming the cantaloupe and will therefore not have to worry about shelf life or risk of mold formation.

How to Enjoy

A Few Quick Serving Ideas

- Add some sparkling water to fresh squeezed cantaloupe juice for a delightfully refreshing drink in the warm months of the year.
- In a blender or food processor, purée cantaloupe and peeled soft peaches to make delicious cold soup. Add lemon juice and honey to taste.
- Top cantaloupe slices with yogurt and chopped mint.
- Slice melons in half horizontally, scoop out seeds and use each half as a basket in which to serve fruit salad.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Cantaloupe, cubed, fresh **1.00 cup** **160.00 grams**				**Calories: 54** **GI: medium**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin C	58.72 mg	78	25.9	excellent
vitamin A	270.56 mcg RAE	30	9.9	excellent
potassium	427.20 mg	12	4.0	very good
folate	33.60 mcg	8	2.8	good
copper	0.07 mg	8	2.6	good
vitamin B3	1.17 mg	7	2.4	good
vitamin B6	0.12 mg	7	2.3	good
vitamin B1	0.07 mg	6	1.9	good
fiber	1.34 g	5	1.8	good
magnesium	19.20 mg	5	1.6	good
vitamin K	4.00 mcg	4	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Cranberries

What's New and Beneficial About Cranberries

- For many years, researchers believed that the ability of cranberries and cranberry juice to help prevent urinary tract infections (UTIs) was partly related to the strong acidity of the cranberries. Recent research has shown that it's not the acidity of the cranberries, but the unusual nature of their proanthocyanidins (PACs) that is related to prevention of UTIs. The special structure of these PACs (involving A-type linkages between their components) acts as a barrier to bacteria that might otherwise latch on to the urinary tract lining. In many studies, the UTI-preventing benefits of cranberries are somewhat modest and limited to women who have recurrent UTIs. But this whole area of investigation has opened the door to an understanding of other possible cranberry benefits. For example, stomach ulcers are often related to overgrowth and over-linking of one particular type of stomach bacteria (*Helicobacter pylori*) to the stomach lining. In much the same way as cranberries may help prevent bacterial attachment to the lining of the urinary tract, they may also help prevent attachment of bacteria to the stomach lining. There is already some preliminary evidence that cranberry may help protect us from stomach ulcer in this way. We expect to see future studies confirming this fascinating type of health benefit.
- Many cranberries are water-harvested. Water-harvesting means that the cranberries are grown in bogs and floated in water to allow for easy harvesting. For many years, water-harvesting of cranberries has been looked upon as an industry convenience. It's simply easier to harvest berries that are floating on the surface. However, recent research has shown that the anthocyanin content of cranberries (the phytonutrients that give the berries their amazing red color) is increased in direct proportion to the amount of natural sunlight striking the berry. If berries floating on top of water get exposed to increased amounts of natural sunlight (in comparison to other growing and harvesting conditions), they are likely to develop greater concentrations of anthocyanins. These greater concentrations of anthocyanins are likely to provide us with stronger health benefits. In other words, water-harvesting may turn out to provide more than just harvest convenience. If it can expose cranberries to greater amounts of natural sunlight, it can increase phytonutrient health benefits that involve the unique antioxidant and anti-inflammatory properties of anthocyanins.
- A substantial number of recent studies have shown that whole cranberries consumed in dietary form—in comparison with purified cranberry extracts consumed in either liquid or dried supplement form—do a better job of protecting our cardiovascular system and our liver. Several groups of researchers have summarized their health benefit findings by pointing out that it is the synergy among cranberry nutrients (rather than individual cranberry components) that is responsible for cranberry's health benefits. This synergy is only found in the whole berry as consumed in food form. This rule about whole dietary intake appears to apply to the antioxidant benefits, anti-inflammatory benefits, and anti-cancer benefits of cranberry.
- Over the past 5 years, scientists have identified an increasing number of mechanisms that help explain the anti-cancer properties of cranberries. These mechanisms are now known to include: blocked expression of MMPs (matrix metalloproteinases); inhibition of ODC (ornithine decarboxylase enzymes); stimulation of QRs (quinone reductase enzymes); inhibition of CYP2C9s (Phase I detoxification enzymes); and triggering of apoptosis (programmed cell death) in tumor cells. The cancer-preventive benefits of cranberries are now known to extend to cancers of the breast, colon, lung, and prostate.

WHFoods Recommendations

In our Healthiest Way of Eating Plan, we encourage the consumption of 5-10 servings of fruits-plus-vegetables (combined) eat day. We believe that the balance between fruits and vegetables can vary from day to day, depending upon personal health factors, personal taste preferences, and optimal combining of foods in recipes as well as meals. We recognize that our recommendation calls for a more generous amount of fruits and vegetables than the amount recommended by the Centers for Disease Control (CDC) at the U.S. Department of Health and Human Services (DHHS). The CDC recommends between 1.5-2.5 cups of fruit and 2.5-4.0 cups of vegetables per day, as well as a target goal of at least 5 fruit-plus-vegetable servings (combined) per day. With respect to berries, the CDC approach provides the example of strawberries, and explains that 8 large strawberries count as 1 cup. If all fruit for the day were to be obtained from strawberries, the CDC recommendation would translate into 12-20 strawberries for the day as a way of meeting a requirement for 1.5-2.5 cups of fruit. We recommend that you set your fruit goals higher than these CDC amounts. Based on the scientific research, we believe it's going to take closer to 3 fruit servings per day to provide you with optimum health benefits. With respect to berries in particular, we recommend that you include berries at least 3-4 times per week within your fruit servings. In several of our sample meal plans, we include berries on a daily basis! It would definitely not be a mistake for you to include a serving of berries in your daily meal plan! At the same time, we recognize that the fruit group contains many outstanding fruit options, and personal preferences (as well as local and seasonal availability) can vary greatly. Also, remember that large strawberries—at about 18 grams per berry and 8 berries per cup—stand at one end of the berry range in terms of size and recommended amount. Most berries are considerably smaller in size and weight, and a one-cup serving allows you to eat a lot more berries! With blueberries, for example, the average weight per berry is closer to 1-2 grams, and a cup's worth of blueberries means about 100-150 berries. For cranberries and raspberries, the amount would be similar.

Among the fruits and vegetables richest in health-promoting antioxidants berries such as cranberries rank right up there at the top of the list. Antioxidants are essential to optimizing health by helping to combat the free radicals that can damage cellular structures as well as DNA. Provided that you do not experience any digestive difficulty, we recommend enjoying cranberries raw because they provide you with the best flavor and the greatest benefits from their vast array of nutrients, and may also offer the benefit of digestion-aiding enzymes. When you think about the flavors, nutrients, and enzyme content of raw fruit, it is no surprise that for thousands of years both in Asia and along the Mediterranean, people have been eating raw fruit for dessert, not only as a delicious and nutritious ending to a meal but also as a potential digestive aid. For more on the Healthiest Way of Preparing Cranberries, see the How to Enjoy section below.

Cranberries, fresh, whole
1.00 cup
(100.00 grams)

Calories: 46
GI: low

Nutrient	DRI/DV
manganese	18%
vitamin C	18%
fiber	18%
vitamin E	8%
copper	7%
vitamin K	6%
pantothenic acid	6%

Health Benefits

While familiar nutrients like vitamin C and fiber play a very important role in cranberry's health benefits, it's the amazing array of phytonutrients in cranberries that has gotten the special attention of health researchers. There are at least 5 key categories of health-supportive phytonutrients in cranberries, as summarized in the following chart:

Cranberry Phytonutrients

Type of Phytonutrient	Specific Molecules
Phenolic Acids	hydroxybenzoic acids including vanillic acids; hydroxycinnamic acids inculding caffeic, coumaric, cinnamic, and ferulic acids
Proanthocyanidins	epicatechins
Anthocyanins	cyanidins, malvidins, and peonidins
Flavonoids	quercetin, myricetin, kaempferol
Triterpenoids	ursolic acid

The vast majority of phytonutrients presented in this chart have been studied for their antioxidant, anti-inflammatory, and anti-cancer properties, and in many cases the results have been impressive. Equally important in the cranberry research has been the finding that isolated phytonutrients in cranberry do not account for the same degree of health benefit as phytonutrients taken as a complete, synergistic group. What this research finding means is simple: it's the whole cranberry that supports our health best.

When speaking in general terms about the health benefits of cranberries, it is also important to know that the most commonly consumed form of this food is juice processed from the berries and typically produced by adding generous amounts of sugar. This form of cranberry cannot provide you with cranberry's full phytonutrient benefits. The cranberry "presscake"—or what is left behind in terms of skins and flesh after the juice has been processed out—typically contains the bulk of the phytonutrients when evaluated in lab studies.

Protection against Urinary Tract Infection (UTI)

Long before researchers started investigating from the standpoint of science, cranberry has been used to help prevent and treat urinary tract infections (UTIs). While the acidity of cranberries was at one time an important target of research, we now know that cranberry's ability to provide UTI benefits is not primarily related to its acidity, but rather to its proanthocyanidin (PAC) content. The PACs in cranberry have a special structure (called A-type linkages) that makes it more difficult for certain types of bacteria to latch on to our urinary tract linings. Include in these types of bacteria are pathogenic (infection-causing) strains of *E. coli*—one of the most common microorganisms involved in UTIs. By making it more difficult for unwanted bacteria like *E. coli* to cling onto the urinary tract linings, cranberry's PACs help prevent the expansion of bacterial populations that can result in outright infection. The age group in which researchers are least sure about this process involves children—it's just not clear when cranberry's health benefits fully extend to this age group. The area where benefits have been most pronounced are in middle-aged women who have experienced recurrent UTIs. In some studies, UTIs in this age and gender group have been reduced by more than one—third through dietary consumption of cranberry.

The discovery that cranberries prevent UTIs by blocking adhesion of bacteria to the urinary tract lining is a discovery that has allowed research on cranberry to expand out in other important directions. In our Digestive Benefits section below, we will describe how prevention of stomach ulcer is one very intriguing new direction in the cranberry research, based on this exact same principle of blocking bacterial adhesion to the lining of an organ system. (In the case of stomach ulcer, it's the stomach lining that's at risk, and the bacteria involved are the *Helicobacter pylori* bacteria.)

Anti-Inflammatory Benefits

For the cardiovascular system and for many parts of the digestive tract (including the mouth and gums, stomach, and colon) cranberry has been shown to provide important anti-inflammatory benefits. It's the phytonutrients in cranberry that are especially effective in lowering our risk of unwanted inflammation, and virtually all of the phytonutrient categories represented in cranberry are now known to play a role. These phytonutrient categories include proanthocyanidins (PACs), anthocyanins (the flavonoid pigments that give cranberries their amazing shades of red), flavonols like quercetin, and phenolic acid (like hydroxycinnamic acids).

In the case of our gums, the anti-inflammatory properties of cranberry can help us lower our risk of periodontal disease. Chronic, excessive levels of inflammation around our gums can damage the tissues that support our teeth. It's exactly this kind of inflammation that gets triggered by ongoing overproduction of certain cytokines. (Cytokines are messaging molecules, and the pro-inflammatory cytokines tell our cells to mount an inflammatory response. As messages are sent more frequently and more constantly, the inflammatory response becomes greater.) Phytonutrients in cranberry help reduce this inflammatory cascade of events precisely at the cytokine level. Production of pro-inflammatory cytokines like interleukin 6 (IL-6) and RANTES (Regulated Activation Normal T-cell Expressed and Secreted) is lowered by the activity of cranberry phytonutrients. In addition, cranberry phytonutrients inhibit the activity of the enzymes cyclo-oxygenase 1 (COX-1) and cyclo-oxygenase 2 (COX-2). These COX-1 and COX-2 enzymes are key factors in the production of other pro-inflammatory messaging molecules, and by inhibiting these enzymes, cranberry's phytonutrients significantly lower our risk of unwanted inflammation.

Dietary consumption of cranberry has also been shown to reduce the risk of chronic, unwanted inflammation in the stomach, large intestine (colon) and cardiovascular system (especially blood vessel linings). We'll discuss some of these health benefits in more detail in the Digestive Benefits and Cardiovascular Benefits sections of this cranberry profile.

Immune Support

While research in this area is somewhat limited, recent studies on the immune support benefits of cranberry are exciting. In studies on very small numbers of human participants, intake of cranberry extracts has shown the ability to improve multiple aspects of immune function, and to lower the frequency of cold and flu symptoms in the subjects. In several of these studies, the cranberry extracts were standardized to contain a known, higher-end amount of proanthocyanidins (PACs)—somewhat comparable to a double-strength cranberry juice. From our perspective, the doses of cranberry extract used in these studies match up fairly well with generous intake of whole, raw cranberries, and we look forward to future studies focused on precisely that: intake of whole, raw cranberries and resulting changes in cold and flu symptoms.

Cardiovascular Benefits

Following decreased risk of urinary tract infection (UTI), increased health of the cardiovascular system is perhaps the best-researched area of cranberry health benefits. It's the combined impact of cranberry antioxidants and anti-inflammatory phytonutrients in cranberry that's responsible here. Oxidative stress and chronic inflammation can place our blood vessel walls at great risk of damage. Once damaged, our blood vessels walls can undergo a process of plaque formation, and our risk of atherosclerosis (blood vessel wall thickening and blood vessel blocking) can be greatly increased. Dietary intake of cranberries and cranberry juice (in normal everyday amounts, unchanged for research study purposes) has been shown to prevent the triggering of two enyzmes that are pivotal in the atherosclerosis process (inducible nitric oxide synthase, or iNOS, and cyclo-oxygenase 2, or COX-2). In both cases, cranberry has also been shown to prevent activation of these enzymes by blocking activity of a pro-inflammatory cytokine-messaging molecule called tumor necrosis factor alpha (TNF-alpha). These anti-inflammatory benefits of cranberry appear to be critical components in the cardiovascular protection offered by this amazing fruit.

The antioxidant components of cranberries also appear to play a key role in cranberry's cardiovascular benefits. In animal studies, these antioxidant benefits have been clearly associated with decreased risk of high blood pressure. By reducing oxidative stress inside the blood vessels, cranberry extracts consumed by rats and mice have helped prevent overconstriction of the blood vessels and unwanted increases in blood pressure.

Three related phytonutrient compounds—resveratrol, piceatannol, and pterostilbene—deserve special mention with respect to cranberry's antioxidants. These unique phytonutrients may provide cranberry with some equally unique antioxidant properties, and a special ability to support our cardiovascular system in this regard.

A final area of cardiovascular support provided by cranberry is its ability to help us lower our LDL-cholesterol and total cholesterol, while simultaneously helping us increase our level of HDL-cholesterol. Cranberry most likely helps us achieve these cholesterol-improving changes by helping to improve oxidative and inflammatory aspects of the everyday environment in which our cholesterol-containing molecules must exist. This improved cholesterol control offered by cranberry contributes even further to our decreased risk of blood vessel blocking problems, since excess accumulation of LDL-cholesterol and insufficient amounts of HDL-cholesterol can increase the tendency of our blood vessels to become blocked. All in all, it's quite amazing how a simple food like cranberry can provide us with cardiovascular benefits at so many different levels, all rolled into one.

Antioxidant Protection

Although previously mentioned in this Health Benefits section, the antioxidants found in cranberry are especially important contributors to its potential for health support. From a research perspective, there are two especially important points to consider when thinking about the antioxidant benefits of cranberries. First is the amazing array of antioxidants that are found exclusively in whole cranberries. Cranberry's special combination of phenolic antioxidants, proanthocyanidin antioxidants, anthocyanin antioxidants, flavonoid antioxidants, and triterpenoid antioxidants is without a doubt unique. Also unique is the particular combination of three antioxidant nutrients—resveratrol, piceatannol, and pterostilbene—found in cranberry. Second are the research findings regarding the synergy between these nutrients. The phytonutrients in cranberry provide maximal antioxidant benefits only when consumed in combination with each other, and also only when consumed alongside of conventional antioxidant nutrients present in cranberry like manganese and vitamin C. When cranberry processing disrupts this antioxidant combination, health benefits from cranberry are decreased. Multiple studies in multiple health benefit areas point to this same conclusion—it's the overall blend of cranberry antioxidants that provides us with the strongest health benefits.

One further point about cranberry antioxidant research seems worthy of mention. In several research studies, cranberries were unable to provide significant antioxidant benefits when those benefits were measured in terms of blood values. In these studies, it took a much closer look at activities going on inside of our cells to demonstrate the antioxidant benefits of cranberries. The need to look inside of our cells to find cranberry antioxidant benefits may be telling us that the special value of cranberries may often involve metabolic events that are taking place "behind the scenes." In other words, these benefits may sometimes be missed in more broadly focused research studies, and cranberry may in fact have a stronger research track record than previously assumed.

Anti-Cancer Benefits

No area of cranberry research has been more intriguing in the past 10 years than research on cranberry and cancer, even though the majority of studies in this area have involved lab studies on human cancer cells or animal experiments. On a virtual year-by-year basis, scientists continue to identify new mechanisms that establish cranberries as anti-cancer agents. These mechanisms are now known to include: blocked expression of MMPs (matrix metalloproteinases); inhibition of ODC (ornithine decarboxylase enzymes); stimulation of QRs (quinone reductase enzymes); inhibition of CYP2C9s (Phase I detoxification enzymes); and triggering of apoptosis (programmed cell death) in tumor cells. It's important to point out that this amazing list of anti-cancer properties in cranberry is not sufficient to establish cranberry as a food to be used in the treatment of cancer. However, it is a list that appears consistent with other studies of cranberry and cancer showing dietary intake of this food to help prevent cancer occurrence. These cancer-preventive benefits of cranberry are especially likely in the case of breast, colon, lung, and prostate cancer.

None of the cancer-related benefits of cranberries should be surprising, since cranberry is loaded with antioxidant and anti-inflammatory nutrients. Chronic excessive oxidative stress (from lack of sufficient antioxidant support) and chronic excessive inflammation (from lack of sufficient anti-inflammatory compounds) are two key risk factors promoting increased likelihood of cancer. With its unique array of antioxidant and anti-inflammatory nutrients, cranberry seems ideally positioned to help us lower our risk of cancer development.

Digestive Tract Benefits

When you add up the health-related benefits of cranberry for our mouth and gums (decreased risk of periodontal disease), stomach (decreased risk of stomach ulcer), and colon (decreased risk of colon cancer), it's impossible not to conclude that cranberry is unique among fruits in its ability to provide us with digestive tract benefits. Every category of phytonutrient known to be provided by cranberry is also known to play a role in digestive tract support. In the case of cranberry's proanthocyanidins, it's decreased adherence of the bacterium *Helicobacter pylori* to our stomach wall that's made possible by intake of cranberry. In the case of cranberry's flavonoids, anthocyanins and triterpenoids, provide antioxidant and anti-inflammatory benefits that decrease our risk of colon cancer, and also our risk of periodontal disease.

Recent research has also shown that cranberry may be able to help optimize the balance of bacteria in our digestive tract. Participants in one recent study involving cranberry juice intake (in amounts of approximately 2 ounces per day and over the course of about 3 months) were able to increase the numbers of *Bifidobacteria* in their digestive tract while maintaining other bacterial types (*Bifidobacteria* are typically considered to be a desirable and "friendly" type of bacteria). As a result, the relative amount of *Bifidobacteria* was increased, and the bacterial environment of the digestive tract may have become more favorable. Given the vast array of phytonutrients in cranberry and the known connection between so many of these phytonutrients and digestive tract health, we expect to see the digestive benefits of cranberry becoming more and more apparent in future research on this incredible berry.

Description

A glossy, scarlet red, very tart berry, the cranberry belongs to the same genus as the blueberry, *Vaccinium*. (Both berries also belong to the food family called *Ericaceae*, also known as the heath or heather family.) Like blueberries, cranberries can still be found growing as wild shrubs in northern Europe, northern Asia, and North America. When cultivated, however, cranberries are grown on low trailing vines atop great sandy bogs.

Cranberries have also been called "bounceberries," because ripe ones bounce, and "craneberries," a poetic allusion to the fact that their pale pink blossoms look a bit like the heads of the cranes that frequent cranberry bogs. The variety cultivated commercially in the northern United States and southern Canada, the American cranberry, produces a larger berry than either the Southern cranberry, a wild species that is native to the mountains of the eastern United States, or the European variety.

Cranberries have long been valued for their ability to help prevent and treat urinary tract infections. Now, recent studies suggest that this native American berry may also promote gastrointestinal and oral health, lower LDL and raise HDL (good) cholesterol, aid in recovery from stroke, and even help prevent cancer.

Fresh cranberries, which contain the highest levels of beneficial nutrients, are at their peak from October through December, just in time to add their festive hue, tart tangy flavor and numerous health protective effects to your holiday meals. When cranberries' short fresh season is past, rely on unsweetened cranberry juice made from whole berries and dried or frozen cranberries to help make every day throughout the year a holiday from disease.

History

American Indians enjoyed cranberries cooked and sweetened with honey or maple syrup—a cranberry sauce recipe that was likely a treat at early New England Thanksgiving feasts. By the beginning of the 18th century, the tart red berries were already being exported to England by the colonists. Cranberries were also used by the Indians decoratively, as a source of red dye, and medicinally, as a poultice for wounds since not only do their astringent tannins contract tissues and help stop bleeding, but we now also know that compounds in cranberries have antibiotic effects.

Although several species of cranberries grow wild in Europe and Asia and have always been enjoyed in these part of the world, the cranberry most cultivated as a commercial crop is an American native, which owes its success to one Henry Hall, an observant gentleman in Dennis, Massachusetts. In 1840, Mr. Hall noticed an abundance of large berries grew when sand was swept into his bog by the prevailing winds and tides. The sandy bog provided just the right growing conditions for the cranberries by stifling the growth of shallow-rooted weeds, thus enhancing that of the deep rooted cranberries.

Cranberry cultivation soon spread not only across the U.S. through Wisconsin to Washington and Oregon, but also across the sea to Scandinavia and Great Britain. The hardy berries arrived in Holland as survivors of a shipwreck. When an American ship loaded with crates filled with cranberries sank along the Dutch coast, many crates washed ashore on the small island of Terschelling; some of the berries took root, and cranberries have been cultivated there ever since.

In terms of scientific classifications, one of the most common cranberry types is *Vaccinium oxycoccos*, sometimes referred to as European cranberry. This species of cranberry is native to the Northern Hemisphere and found not only in Northern Europe but also Northern Asia and Northern North America. Another common type—*Vaccinium macrocarpon*—is larger and more common along the eastern parts of the United States and Canada. This is the cranberry species that is most widely commercially cultivated. *Vaccinium microcarpum* is a smaller cranberry species that is most widely found in Northern Europe and Northern Asia.

How to Select and Store

A fruit with a short season, fresh cranberries are harvested between Labor Day and Halloween and appear in markets from October through December.

Choose fresh, plump cranberries, deep red in color, and quite firm to the touch.

Firmness is a primary indicator of quality. In fact, during harvesting, high quality cranberries are often sorted from lesser quality fruits by bouncing the berries against barriers made of slanted boards. The best berries bounce over the barriers, while the inferior ones collect in the reject pile.

The deeper red their color, the more highly concentrated are cranberries' beneficial anthocyanin compounds. The Early Black cultivar (variety) of cranberry—with its particularly deep red color—has been found in one research study to have the highest concentration of anthocyanins.

Although typically packed in 12-ounce plastic bags, fresh cranberries, especially if organic, may be available in pint containers.

Fresh ripe cranberries can be stored in the refrigerator for up to 20 days. Before storing, discard any soft, discolored, pitted or shriveled fruits. When removed from the refrigerator, cranberries may look damp, but such moistness does not indicate spoilage, unless the berries are discolored or feel sticky, leathery or tough.

Once frozen, cranberries may be kept for several years. To freeze, spread fresh cranberries out on a cookie sheet and place in the freezer. In a couple of hours, the fully frozen berries will be ready to transfer to a freezer bag. Don't forget to date the bag before returning to the freezer.

Once thawed, frozen berries will be quite soft and should be used immediately.

Dried cranberries are sold in many groceries and may be found with other dried fruits.

How to Enjoy

A Few Quick Serving Ideas

- Take advantage of cranberries' tartness by using them to replace vinegar or lemon when dressing your green salads. Toss the greens with a little olive oil and then add color and zest with a handful of raw cranberries.
- To balance their extreme tartness, combine fresh cranberries with other fruits such as oranges, apples, pineapple or pears. If desired, add a little fruit juice, honey or maple syrup to chopped fresh cranberries.
- For an easy-to-make salad that will immediately become a holiday favorite, place 2 cups fresh berries in your blender along with 1/2 cup of pineapple chunks, a quartered skinned orange, a sweet apple (such as one of the Delicious variety) and a handful or two of walnuts or pecans. Blend till well mixed but still chunky. Transfer to a large bowl.
- Dice 3-4 stalks of celery, add to the cranberry mixture and stir till just combined.
- Combine unsweetened cranberry in equal parts with your favorite fruit juice and sparkling mineral water for a lightly sweetened, refreshing spritzer. For even more color appeal, garnish with a slice of lime.
- Add color and variety to your favorite recipes for rice pudding, quick breads or muffins by using dried cranberries instead of raisins.
- Sprinkle a handful of dried cranberries over a bowl of hot oatmeal, barley, or any cold cereal.
- Mix dried cranberries with lightly roasted and salted nuts for a delicious snack.

WHFoods Recipes That Feature Cranberries

- Perfect Oatmeal
- Swiss Breakfast
- Cranberry Sauce
- Holiday Cranberry Relish

Safety

Cranberries and Warfarin

Warfarin is a prescription anticoagulant medication that has widely been used to help prevent formation of blood clots in individuals with a strong tendency toward clotting, and to help prevent future episodes in individuals who have already experienced formation of unwanted blood clots. Over the past ten years, there have been a small number of published case studies reporting cranberry juice-related problems by individuals taking warfarin. Despite the small number of cases, however, these reported problems have been quite serious, and in one circumstance, involved the death of an individual who was following his doctor's medical prescription for warfarin and while also consuming cranberry juice. The connection between cranberry juice and warfarin treatment has now been clearly shown to involve the detoxification enzyme family CYP2C9. The activity of this enzyme family is needed to break down warfarin so that its anticoagulant activity does not become excessive. (If CYP2C9 enzymes in the liver cannot successfully metabolize and neutralize warfarin, it can become too difficult for a person to stop an occurrence of bleeding.) Even though we now know that cranberry juice can inhibit CYP2C9 enzymes, researchers are still not clear about the risk posed by cranberries and cranberry juice for individuals who have been placed on a warfarin prescription. In lab studies, cranberry juice has repeatedly been shown to inhibit the breakdown of warfarin by CYP2C9 enzymes. However, in a recent study on health human volunteers who consumed three 8.5-ounce glasses of double-strength cranberry juice along with a single dose of warfarin, this inhibiting of CYP29C enzymes failed to occur. Overall, these research results seem somewhat confusing, and to err on the safe side, we encourage and recommend that all persons taking warfarin consult with their healthcare provider before incorporating cranberries or cranberry juice into the diet.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Cranberries, fresh, whole
1.00 cup
100.00 grams

Calories: 46
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
fiber	4.60 g	18	7.2	very good
manganese	0.36 mg	18	7.0	very good
vitamin C	13.30 mg	18	6.9	very good
vitamin E	1.20 mg (ATE)	8	3.1	good
copper	0.06 mg	7	2.6	good
pantothenic acid	0.29 mg	6	2.3	good
vitamin K	5.10 mcg	6	2.2	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
	DRI/DV>=50% OR

very good	Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Figs

Although dried figs are available throughout the year, there is nothing like the unique taste and texture of fresh figs. They are lusciously sweet with a texture that combines the chewiness of their flesh, the smoothness of their skin, and the crunchiness of their seeds. California figs are available from June through September; some European varieties are available through autumn.

Figs grow on the Ficus tree (Ficus carica), which is a member of the Mulberry family. They are unique in that they have an opening, called the "ostiole" or "eye," which is not connected to the tree, but which helps the fruit's development by increasing its communication with the environment. Figs range dramatically in color and subtly in texture depending upon the variety. The majority of figs are dried, either by exposure to sunlight or through an artificial process, creating a sweet and nutritious dried fruit that can be enjoyed throughout the year.

Figs, fresh
1.00 medium
(50.00 grams)

Calories: 37
GI: medium

Nutrient	DRI/DV
fiber	6%
vitamin B6	4%
copper	3%
manganese	3%
potassium	3%
pantothenic acid	3%

Health Benefits

Help Lower High Blood Pressure

Figs are a good source of potassium, a mineral that helps to control blood pressure. Since many people not only do not eat enough fruits and vegetables, but do consume high amounts of sodium as salt is frequently added to processed foods, they may be deficient in potassium. Low intake of potassium-rich foods, especially when coupled with a high intake of sodium, can lead to hypertension. In the Dietary Approaches to Stop Hypertension (DASH) study, one group ate servings of fruits and vegetables in place of snacks and sweets, and also ate low-fat dairy food. This diet delivered more potassium, magnesium and calcium. Another group ate a "usual" diet low in fruits and vegetables with a fat content like that found in the average American Diet. After eight weeks, the group that ate the enhanced diet lowered their blood pressure by an average of 5.5 points (systolic) over 3.0 points (diastolic).

A Sweet Way to Lose Weight

Figs are a good source of dietary fiber. Fiber and fiber-rich foods may have a positive effect on weight management. In one study, women who increased their fiber intake with supplements significantly decreased their energy intake, yet their hunger and satiety scores did not change. Figs, like other high fiber foods, may be helpful in a weight management program.

Fruit and Cereal Fiber Protective against Postmenopausal Breast Cancer

Results of a prospective study involving 51,823 postmenopausal women for an average of 8.3 years showed a 34% reduction in breast cancer risk for those consuming the most fruit fiber compared to those consuming the least. In addition, in the subgroup of women who had ever used hormone replacement, those consuming the most fiber, especially cereal fiber, had a 50% reduction in their risk of breast cancer compared to those consuming the least. Fruits richest in fiber include apples, dates, figs, pears and prunes. When choosing a high fiber cereal, look for whole grain cereals as they supply the most bran (a mere 1/3rd cup of bran contains about 14 grams of fiber).

An Insulin-Lowering Leaf in Diabetes

You probably do not think about the leaves of the fig tree as one of fig's edible parts. But in some cultures, fig leaves are a common part of the menu, and for good reason. The leaves of the fig have repeatedly been shown to have antidiabetic properties and can actually reduce the amount of insulin needed by persons with diabetes who require insulin injections. In one study, a liquid extract made from fig leaves was simply added to the breakfast of insulin-dependent diabetic subjects in order to produce this insulin-lowering effect.

Cardiovascular Effects

In animal studies, fig leaves have been shown to lower levels of triglycerides (a form in which fats circulate in the bloodstream), while in *in vitro* studies, fig leaves inhibited the growth of certain types of cancer cells. Researchers have not yet determined exactly which substances in fig leaves are responsible for these remarkable healing effects.

Besides their potassium and fiber content, figs emerged from our food ranking system as a good source of the trace mineral manganese.

Protection against Macular Degeneration

Your mother may have told you carrots would keep your eyes bright as a child, but as an adult, it looks like fruit is even more important for keeping your sight. Data reported in a study published in the Archives of Ophthalmology indicates that eating 3 or more servings of fruit per day may lower your risk of age-related macular degeneration (ARMD), the primary cause of vision loss in older adults, by 36%, compared to persons who consume less than 1.5 servings of fruit daily.

In this study, which involved over 100,00 women and men, researchers evaluated the effect of study participants' consumption of fruits; vegetables; the antioxidant vitamins A, C, and E; and carotenoids on the development of early ARMD or neovascular ARMD, a more severe form of the illness associated with vision loss. Food intake information was collected periodically for up to 18 years for women and 12 years for men.

While, surprisingly, intakes of vegetables, antioxidant vitamins and carotenoids were not strongly related to incidence of either form of ARMD, fruit intake was definitely protective against the severe form of this vision-destroying disease. Three servings of fruit may sound like a lot to eat each day, but by simply tossing a banana into your morning smoothie or slicing it over your cereal, topping off a cup of yogurt or green salad with a couple of diced figs, and snacking on an apple, plum, nectarine or pear, you've reached this goal.

Description

Figs are not only the main ingredient in a very popular cookie, the fig bar, but are a culinary delicacy par excellence. Part of the wonder of the fig comes from its unique taste and texture. Figs are lusciously sweet and feature a complex texture that combines the chewiness of their flesh, the smoothness of their skin, and the crunchiness of their seeds. In addition, since fresh figs are so delicate and perishable, some of their mystique comes from their relative rarity. Because of this, the majority of figs are dried, either by exposure to sunlight or through an artificial process, creating a sweet and nutritious dried fruit that can be enjoyed throughout the year.

Figs grow on the Ficus tree (*Ficus carica*), which is a member of the Mulberry family. They are unique in that they have an opening, called the "ostiole" or "eye," which is not connected to the tree, but which helps the fruit's development, aiding it in communication with the environment.

Figs range dramatically in color and subtly in texture depending upon the variety, of which there are more than one hundred and fifty. Some of the most popular varieties are:

- Black Mission: blackish-purple skin and pink colored flesh
- Kadota: green skin and purplish flesh
- Calimyrna: greenish-yellow skin and amber flesh
- Brown Turkey: purple skin and red flesh
- Adriatic: the variety most often used to make fig bars, which has a light green skin and pink-tan flesh

History

Figs can trace their history back to the earliest of times with mentions in the Bible and other ancient writings. They are thought to have been first cultivated in Egypt. They spread to ancient Crete and then subsequently, around the 9th century BC, to ancient Greece, where they became a staple foodstuff in the traditional diet. Figs were held in such esteem by the Greeks that they created laws forbidding the export of the best quality figs. Figs were also revered in ancient Rome where they were thought of as a sacred fruit. According to Roman myth, the wolf that nurtured the twin founders of Rome, Romulus and Remus, rested under a fig tree. During this period of history, at least 29 varieties of figs were already known.

Figs were later introduced to other regions of the Mediterranean by ancient conquerors and then brought to the Western Hemisphere by the Spaniards in the early 16th century. In the late 19th century, when Spanish missionaries established the mission in San Diego, California, they also planted fig trees. These figs turned out to be inferior in quality to those that were imported from Europe, and it wasn't until the development of further cultivation techniques in the early 20th century that California began focused cultivation and processing of figs. Today, California remains one of the largest producers of figs in addition to Turkey, Greece, Portugal and Spain.

How to Select and Store

Since fresh figs are one of the most perishable fruits, they should be purchased only a day or two in advance of when you are planning on eating them. Look for figs that have a rich, deep color and are plump and tender, but not mushy. They should have firm stems and be free of bruises. Smelling figs can also give you clues into their freshness and taste. They should have a mildly sweet fragrance and should not smell sour, which is an indication that they may be spoiled.

For the most antioxidants, choose fully ripened figs:

Research conducted at the University of Innsbruck in Austria suggests that as fruits fully ripen, almost to the point of spoilage, their antioxidant levels actually increase.

Key to the process is the change in color that occurs as fruits ripen, a similar process to that seen in the fall when leaves turn from green to red to yellow to brown—a color change caused by the breakdown and disappearance of chlorophyll, which gives leaves and fruits their green color.

California figs are available from June through September with the exact timing varying with the variety. Some European figs are often available throughout autumn. When purchasing dried figs, make sure that they are still relatively soft, free of mold, and have a mellow, pleasant smell. Dried figs are available throughout the year.

Ripe figs should be kept in the refrigerator where they will stay fresh for about two days. Since they have a delicate nature and can easily bruise, you should store them either arranged on a paper towel-lined plate or shallow container. They should be covered or wrapped in order to ensure that they do not dry out, get crushed or pick up odors from neighboring foods. If you have purchased slightly under-ripe figs, you should keep them on a plate, at room temperature, away from direct sunlight. Dried figs will stay fresh for several months and can either be kept in a cool, dark place or stored in the refrigerator. They should be well wrapped so that they are not over exposed to air that may cause them to become hard or dry.

How to Enjoy

A Few Quick Serving Ideas

When preparing oatmeal or any other whole grain breakfast porridge, add some dried or fresh figs.

Poach figs in juice or red wine and serve with yogurt or frozen desserts.

Add quartered figs to a salad of fennel, arugula and shaved Parmesan cheese.

Fresh figs stuffed with goat cheese and chopped almonds can be served as hors d'oeuvres or desserts.

For some of our favorite recipes, click Recipes.

Safety

Dried Figs and Sulfites

Commercially grown dried figs may be treated with sulfur-containing compounds during processing to extend their shelf life. For details about possible adverse reactions to sulfites, please see our article An Overview of Adverse Food Reactions

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Figs, fresh **1.00 medium** **50.00 grams**				**Calories: 37** **GI: medium**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
fiber	1.45 g	6	2.8	good
vitamin B6	0.06 mg	4	1.7	good
copper	0.03 mg	3	1.6	good
potassium	116.00 mg	3	1.6	good
manganese	0.06 mg	3	1.5	good
pantothenic acid	0.15 mg	3	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Grapefruit

Tart and tangy with an underlying sweetness, grapefruit has a juiciness that rivals that of the ever popular orange and sparkles with many of the same health promoting benefits. Although available throughout the year, they are in season and at their best from winter through early spring.

Grapefruits usually range in diameter from four to six inches and include both seed and seedless and pink and white varieties. The wonderful flavor of a grapefruit is like paradise as is expressed by its Latin name, Citrus paradisi.

Grapefruit, pink, fresh
0.50 medium
(128.00 grams)

Calories: 41
GI: low

Nutrient	DRI/DV
vitamin C	59%
copper	7%
vitamin A	7%
pantothenic acid	7%
fiber	6%
potassium	5%
biotin	4%
vitamin B1	4%

Health Benefits

Rich in the Nutritional Powerhouse Vitamin C

Grapefruit is an excellent source of vitamin C, a vitamin that helps to support the immune system. Vitamin C-rich foods like grapefruit may help reduce cold symptoms or severity of cold symptoms; over 20 scientific studies have suggested that vitamin C is a cold-fighter. Vitamin C also prevents the free radical damage that triggers the inflammatory cascade, and is therefore also associated with reduced severity of inflammatory conditions, such as asthma, osteoarthritis, and rheumatoid arthritis. As free radicals can oxidize cholesterol and lead to plaques that may rupture causing heart attacks or stroke, vitamin C is beneficial to promoting cardiovascular health. Owing to the multitude of vitamin C's health benefits, it is not surprising that research has shown that consumption of vegetables and fruits high in this nutrient is associated with a reduced risk of death from all causes including heart disease, stroke and cancer.

Enjoy Benefits from the Antioxidant Lycopene

The rich pink and red colors of grapefruit are due to lycopene, a carotenoid phytonutrient. (PLEASE NOTE: Lycopene is only found in pink and red grapefruit. White grapefruit does not provide this carotenoid.) Lycopene appears to have anti-tumor activity. Among the common dietary carotenoids, lycopene has the highest capacity to help fight oxygen free radicals, which are compounds that can damage cells.

Choosing to regularly eat lycopene-rich foods, such as pink grapefruit, *and* drink green tea may greatly reduce a man's risk of developing prostate cancer, suggests research published the *Asia Pacific Journal of Clinical Nutrition* (Jian L, Lee AH, et al.)

In this case-control study involving 130 prostate cancer patients and 274 hospital controls, men drinking the most green tea were found to have an 86% reduced risk of prostate cancer compared, to those drinking the least.

A similar inverse association was found between the men's consumption of lycopene-rich fruits and vegetables such as tomatoes, apricots, pink grapefruit, watermelon, papaya, and guava. Men who most frequently enjoyed these foods were 82% less likely to have prostate cancer compared to those consuming the least lycopene-rich foods.

Regular consumption of both green tea and foods rich in lycopene resulted in a synergistic protective effect, stronger than the protection afforded by either, the researchers also noted.

Practical Tips: Get in the habit of drinking green tea and eating lycopene-rich foods.

- Take a quart of iced green tea to work and sip throughout the day or take it to the gym to provide prostate protection while replenishing fluids after your workout.
- Pack a ziploc bag of apricots and almonds in your briefcase or gym bag for a handy snack.
- Start your breakfast with a half grapefruit or a glass of grapefruit, apricot, papaya or guava juice.
- Begin lunch or dinner with some spicy tomato juice on the rocks with a twist of lime. Snack on tomato crostini: in the oven, toast whole wheat bread till crusty, then top with tomato sauce, herbs, a little grated cheese, and reheat until the cheese melts.
- Top whole wheat pasta with olive oil, pine nuts, feta cheese and a rich tomato sauce for lunch or dinner.
- For a delicious dessert, drizzle a little honey over a half grapefruit and broil for 2 minutes. Serve topped with a fresh mint leaf.

Grapefruit Juice Ranked among Those Highest in Antioxidant Activity

Not all fruit juices are the same. They differ markedly in the variety of phenolic compounds and antioxidant activity, according to Alan Crozier, Professor of Plant Biochemistry and Human Nutrition, who, with colleagues at the University of Glasgow, evaluated 13 commercially available popular juices.

Concord grapes came out on top with the highest and broadest range of polyphenols and the highest overall antioxidant capacity. (The main components in purple grape juice were flavan-3-ols, anthocyanins, and hydroxycinnamates, together accounting for 93% of the total phenolic content.)

Other top scorers were cloudy apple juice, cranberry juice and grapefruit juice.

Results for the red grape juice were said to be equal to those for a Beaujolais red wine. Interestingly, however, white grape juice, mainly containing hydroxycinnamates, had the lowest total phenolic content.

The products analyzed were: Spray Classic Cranberry; Welch's Purple Grape; Tesco Pure Pressed Red Grape; Pomegreat Pomegranate; Tesco Pure Apple (clear); Copella Apple (cloudy); Tesco Pure Grapefruit; Tesco Value Pure Orange (concentrate); Tropicana Pure Premium Smooth Orange (squeezed); Tropicana Pure Premium Tropical Fruit; Tesco Pure Pressed White Grape; Tesco Pure Pineapple; Del Monte Premium Tomato.

Dr. Crozier's findings come shortly after those of the *Kame* project, which indicated that long-term fruit juice consumption can provide protection against Alzheimer's disease (Dai et al., *Am J Med*), and suggest that, since each fruit juice contains its own array of protective phenols, drinking a variety may offer the best protection. Practical Tip: "The message is to mix these juices during the week. That way you will get all the compounds with anti-oxidant activity. If you drink only one juice you risk missing out on the compounds in the others," explained Crozier.

Limonoids Promote Optimal Health

Phytonutrients in grapefruit called limonoids inhibit tumor formation by promoting the formation of glutathione-S-transferase, a detoxifying enzyme. This enzyme sparks a reaction in the liver that helps to make toxic compounds more water soluble for excretion from the body. Pulp of citrus fruits like grapefruit contain glucarates, compounds that may help prevent breast cancer.

In animal studies and laboratory tests with human cells, limonoids have been shown to help fight cancers of the mouth, skin, lung, breast, stomach and colon. Now, scientists from the US Agricultural Research Service (ARS) have shown that our bodies can readily absorb and utilize a very long-acting limonoid called limonin that is present is citrus fruits in about the same amount as vitamin C.

In citrus fruits, limonin is present in the form of limonin glucoside, in which limonin is attached to a sugar (glucose) molecule. Our bodies easily digest this compound, cleaving off the sugar and releasing limonin.

In the ARS study, 16 volunteers were given a dose of limonin glucoside in amounts ranging from those that would be found in from 1 to 7 glasses of orange juice. Blood tests showed that limonin was present in the plasma of all except one of the subjects, with concentrations highest within 6 hours after consumption. Traces of limonin were still present in 5 of the volunteers 24 hours after consumption!

Limonin's bioavailability and persistence may help explain why citrus limonoids are potent anti-carcinogens that may prevent cancerous cells from proliferating. Other natural anti-carcinogens are available for much less time; for example, the phenols in green tea and chocolate remain active in the body for just 4 to 6 hours.

The ARS team is now investigating the potential cholesterol-lowering effects of limonin. Lab tests indicate that human liver cells produce less apo B when exposed to limonin. Apo B is a structural protein that is part of the LDL cholesterol molecule and is needed for LDL production, transport and binding, so higher levels of apo B translate to higher levels of LDL cholesterol.

Grapefruit Lowers Cholesterol

Grapefruit contains pectin, a form of soluble fiber that has been shown in animal studies to slow down the progression of atherosclerosis. In one study, animals fed a high-cholesterol diet plus grapefruit pectin had 24% narrowing of their arteries, while animals fed the high-cholesterol diet without grapefruit pectin had 45% narrowing.

Both blond and red grapefruit can reduce blood levels of LDL ("bad") cholesterol, and red grapefruit lowers triglycerides as well, shows a study published in the *Journal of Agricultural and Food Chemistry*.

Israeli researchers from the Hebrew University in Jerusalem first tested the antioxidant potential of blond and red grapefruits and then their cholesterol-lowering potential in humans. The test tube research showed that red grapefruit contains more bioactive compounds and total polyphenols than blond, but both grapefruits are comparable in their content of fiber, phenolic and ascorbic acids, and the flavonoid, naringinen, although red grapefruit contains slightly more flavonoids and anthocyanins.

In this recent study, participants added either red grapefruit, blond grapefruit or no grapefruit to their daily diet. The results indicated that both types of grapefruit appeared to lower LDL cholesterol in just 30 days: total cholesterol by 15.5% in those eating red grapefruit and 7.6% in those eating blond grapefruit; LDL cholesterol by 20.3% and 10.7% respectively; and triglycerides by 17.2% and 5.6% respectively. No changes were seen in the control group (those that didn't eat any grapefruit).

Both red and blond grapefruits both positively influenced cholesterol levels, but red grapefruit was more than twice as effective, especially in lowering triglycerides. In addition, both grapefruits significantly improved blood levels of protective antioxidants. Red grapefruit's better performance may be due to an as yet unknown antioxidant compound or the synergistic effects of its phytonutrients, including lycopene.

In response to this rapid and very positive outcome, the researchers concluded that adding fresh red grapefruit to the diet could be beneficial for persons with high cholesterol, especially those who also have high triglycerides.

One caveat, however: Compounds in grapefruit are known to increase circulating levels of several prescription drugs including statins. For this reason, the risk of muscle toxicity associated with statins may increase when grapefruit is consumed. (See our Individual Concerns section for more information.)

Prevent Kidney Stones

Want to reduce your risk of calcium oxalate kidney stones? Drink grapefruit juice. A study published in the *British Journal of Nutrition* found that when women drank 1/2 to 1 liter of grapefruit, apple or orange juice daily, their urinary pH value and citric acid excretion increased, significantly dropping their risk of forming calcium oxalate stones.

Protection against Colon Cancer

Not only are grapefruit rich in vitamin C, but new research presented at the 228th National Meeting of the American Chemical Society provides two more reasons to drink grapefruit juice: protection against lung and colon cancer.

In humans, drinking three 6-ounce glasses of grapefruit juice a day was shown to reduce the activity of an enzyme that activates cancer-causing chemicals found in tobacco smoke. In rats whose colons were injected with carcinogens, grapefruit and its isolated active compounds (apigenin, hesperidin, limonin, naringin, naringenin, nobiletin) not only increased the suicide (apoptosis) of cancer cells, but also the production of normal colon cells.

Researchers also confirmed that grapefruit may help prevent weight gain by lowering insulin levels.

Grapefruit's Naringenin Repairs DNA

Naringenin, a flavonoid concentrated in grapefruit, helps repair damaged DNA in human prostate cancer cells (cell line LNCaP), reports a lab study published in the *Journal of Nutritional Biochemistry*.

The risk of prostate cancer, the most commonly diagnosed cancer in men in the U.S, increases with age since the older we become, the more times our cells have divided and the greater the chance for DNA mutations to occur. DNA repair is one of the body's primary defense mechanisms against the development of cancer since it removes potentially cancer-causing mutations in cells.

Naringenin helps restore health to damaged DNA by inducing two enzymes that repair DNA during the replication stage. These enzymes, 8-oxoguanine-DNA glycosylase 1 (hOGG1), and DNA polymerase beta (DNA poly beta), are both involved in the DNA base excision repair (BER) pathway.

The scientists in this study exposed cell cultures to 80 micromoles per liter, an amount we cannot achieve by consuming grapefruit since research indicates that only between 2 and 15% flavonoids in the food we consume are absorbed in the GI tract, and plasma concentrations after eating flavonoid-rich foods range from 0.5 to 1 micromole per liter.

Fortunately, however, the researchers also demonstrated that the concentration of naringenin inside the cells that was needed for its beneficial effects was only 5% of the amount in the medium, and this amount is physiologically achievable in our tissues.

Unlike many other cancers, prostate cancer is slow growing initially and often remains undetectable for a long time. Enjoying grapefruit regularly may be one way to prevent its progression by promoting the repair of damaged DNA in prostate cells, thus preventing them from becoming cancerous.

Description

The grapefruit is a large citrus fruit related to the orange, lemon and pomelo. Grapefruits are categorized as white (blond), pink or ruby. However, this terminology doesn't reflect their skin color, which is either yellow or pinkish-yellow, but rather describes the color of their flesh.

Grapefruits usually range in diameter from four to six inches, with some varieties featuring seeds while others are seedless. The wonderful flavor of a grapefruit is like paradise, just as its Latin name Citrus paradisi connotes. It is juicy, tart and tangy with an underlying sweetness that weaves throughout.

History

Grapefruits have a rather recent history, having been discovered in Barbados in the 18th century. Many botanists think the grapefruit was actually the result of a natural cross breeding which occurred between the orange and the pomelo, a citrus fruit that was brought from Indonesia to Barbados in the 17th century.

The resulting fruit was given the name "grapefruit" in 1814 in Jamaica, a name which reflects the way it's arranged when it grows—hanging in clusters just like grapes.

Grapefruit trees were planted in Florida in the early 19th century, although they did not become a viable commercial crop until later that century. Florida is still a major producer of grapefruits, as is California, Arizona and Texas. Other countries that produce grapefruits commercially include Israel, South Africa and Brazil.

How to Select and Store

A good grapefruit doesn't have to be perfect in color. Skin discoloration, scratches or scales may affect the appearance of a grapefruit, but they do not impact the taste or texture quality.

Signs of decay include an overly soft spot at the stem end of the fruit and areas that appear watersoaked. These forms of decay usually translate into poor taste—a flavor that is less vibrant and more bitter than a good quality grapefruit.

The fruits should be heavy for their size as this usually indicates that they feature thin skins and therefore a higher concentration of juicier flesh. Those that have overly rough or wrinkled skin usually tend to be thick skinned and should be avoided.

Grapefruits should be firm, yet slightly springy when gentle pressure is applied. While chilled grapefruits do not have an apparent fragrance, those kept at room temperature should have a subtly sweet aroma. Grapefruits can be purchased throughout the year although the height of the season ranges from winter through early spring. For the most antioxidants, choose fully ripened grapefruit.

Since grapefruits are juicier when they're slightly warm rather than cool, store them at room temperature if you are planning on consuming them within a week of purchase. If you will not be using them within this time period, store them in the refrigerator crisper where they will keep fresh for two to three weeks.

How to Enjoy

A Few Quick Serving Ideas

- Grapefruit sections add a tangy spark to green salads.
- Instead of your morning glass of OJ, have a glass of grapefruit juice.
- Combine diced grapefruit with cilantro and chili peppers to make a unique salsa.
- To enjoy a salad with a tropical flair, combine chopped grapefruit pieces, cooked shrimp and avocadoes and serve on a bed of romaine lettuce.

Safety

Grapefruit and Drug Interactions

Check with your healthcare practitioner about consuming grapefruit juice if you're taking pharmaceutical drugs. Certain pharmaceutical drugs combined with grapefruit juice become more potent. Compounds in grapefruit juice, including naringenin, slow the normal detoxification and metabolism processes in the intestines and liver, which hinders the body's ability to breakdown and eliminate these drugs.

These interactive drugs include the immunosuppressent cyclosporine and calcium channel blocker drugs, such as felodipine, nifedipine and verapamil. Other drugs whose bioavailability is enhanced by grapefruit juice are the antihistamine terfenadine, the hormone estradiol and the antiviral agent saquinavir.

Research also indicates that individuals taking statin drugs should avoid grapefruit. Grapefruit increases the amount of statin drug that reaches the general circulation in two ways. First, grapefruit contains a compound called naringenin, which inactivates an enzyme (cytochrome P450 3A4) in the small intestine that metabolizes statin drugs. Secondly, grapefruit also inhibits P-glycoprotein, a carrier molecule produced in the intestinal wall that would normally transport the statin drug back to the gut. The end result of these two mechanisms is that much more of the statin drug enters the systemic circulation than would normally be the case, leading to a build up in statin levels that can be quite dangerous, and may trigger a rare but serious statin-associated disease called rhabdomyolysis. Rhaddomyolysis affects muscle tissue, usually causing temporary paralysis or weakness, unless the muscle is severely injured.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Grapefruit, pink, fresh
0.50 medium
128.00 grams

Calories: 41
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin C	44.03 mg	59	25.8	excellent
pantothenic acid	0.36 mg	7	3.2	good

copper	0.06 mg	7	2.9	good
vitamin A	59.33 mcg RAE	7	2.9	good
fiber	1.41 g	6	2.5	good
potassium	177.92 mg	5	2.2	good
biotin	1.28 mcg	4	1.9	good
vitamin B1	0.05 mg	4	1.8	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Grapes

Grapes are Our Food of the Week

This week join us in celebrating the crunchy texture and sweet flavor of grapes while they are in the peak of their season. Red, purple, and black grapes are also some of the best sources of resveratrol, the phytonutrients that gives grapes their beautiful dark color and provides antioxidant protection to promote a healthy heart and much more. Enjoy them now when they are the most abundant, most nutritious, and least expensive!

For more on the Food of the Week

- Why is the food of the week among the WHFoods?"
- Healthy Eating with the Seasons

The combination of unique texture and sweet, tart flavor has made grapes an ever popular between-meal snack as well as a refreshing addition to both fruit and vegetable salads.

Grapes are small round or oval berries that feature semi-translucent flesh encased by a smooth skin. Some contain edible seeds while others are seedless. Like blueberries, grapes are often covered by a protective, whitish bloom. Grapes that are eaten as is or used in a recipe are called table grapes and as opposed to wine grapes (used in viniculture) or raisin grapes (used to make dried fruit).

What's New and Beneficial About Grapes

- Several grape phytonutrients are now believed to play a role in longevity. At the top of the list in this area of research is resveratrol (a stilbene phytonutrient present mostly in grape skins, but also in grape seeds and grape flesh). Resveratrol has recently been shown to increase expression of three genes all related to longevity. (These three genes are SirT1s, Fox0s, and PBEFs.) Interestingly, some researchers have shown a parallel between activation of these longevity genes by resveratrol and activation by calorie-restricted diets. In aging and longevity research, our ability to get optimal nutrition for the fewest possible amount of calories is related to our longevity, and the more we can decrease our calories while staying optimally nourished, the better our chances of healthy aging and longevity.
- Grapes have long been classified as a low glycemic index (GI) food, with GI values ranging between 43-53. But having a low GI value is not necessarily the same as having blood sugar benefits. In the case of grapes, recent studies have shown that the low GI value of grapes is also a good indicator of this fruit's blood sugar benefits. Better blood sugar balance, better insulin regulation, and increased insulin sensitivity have now been connected with intake of grape juices, grape extracts, and individual phytonutrients found in grapes.
- The 2014 edition of the Shopper's Guide to Pesticides by the Environmental Working Group has once again identified conventionally grown grapes as one of most problematic fruits and vegetables in terms of pesticide residues. There's new evidence that pesticide residues can be successfully avoided by purchase of certified organic grapes. In a recent study of 99 vineyards in the Aegean Sea area of the Mediterranean, pesticide residues were found on conventionally grown table grapes, but were determined to be undetectable on grapes that had been organically grown. This new evidence adds to our confidence about the added health benefits of selecting organically grown grapes.

WHFoods Recommendations

In our Healthiest Way of Eating Plan, we encourage the consumption of 5-10 servings of fruits-plus-vegetables (combined) eat day. We believe that the balance between fruits and vegetables can vary from day to day, depending upon personal health factors, personal taste preferences, and optimal combining of foods in recipes as well as meals. We recognize that our recommendation calls for a more generous amount of fruits and vegetables than the amount recommended by the Centers for Disease Control (CDC) at the U.S. Department of Health and Human Services (DHHS). The CDC recommends between 1.5-2.5 cups of fruit and 2.5-4.0 cups of vegetables per day, as well as a target goal of at least 5 fruit-plus-vegetable servings (combined) per day. We recommend that you set your fruit goals higher than these CDC amounts. Based on the scientific research, we believe it's going to take closer to 3 fruit servings per day (consisting of one cup's worth of fruit per serving, or 3 cups total per day) to provide you with optimum health benefits.

With respect to berries (and remembering that grapes are included among the berry fruits), we recommend that you include berries at least 3-4 times per week within your fruit servings. In several of our sample meal plans, we include berries on a daily basis! It would definitely not be a mistake for you to include a serving of either grapes, raspberries, blueberries, strawberries, cranberries or other berries in your daily meal plan! When you're including grapes among your daily fruit servings, you should treat one cup as the equivalent of approximately 15-20 grapes. In practice, what this means is that on any given day, if you decide that you would like to consume all 3 of your fruit servings from this delicious food, you can feel confident enjoying up to 45-60 grapes! On another day, if you are primarily in the mood for other kinds of fresh fruit, there is still plenty of room within this 3-serving range to include some fresh grapes on a salad, or enjoy a small cluster along with a snack.

Grapes, fresh
1.00 cup
(151.00 grams)

Calories: 104
GI: low

Nutrient	DRI/DV
vitamin K	25%
copper	21%
vitamin B2	8%

Health Benefits

Few fruits have garnered as much attention in the health research literature as grapes. Part of the reason may be their widespread presence in diets worldwide. With the exception of Antarctica, grapes are cultivated on all of the earth's continents, and researchers from many different countries have been especially interested in this food. But an even greater part of the reason involves the amazing nutrient composition of grapes themselves. Every year, it seems like the list of health-supportive grape nutrients grows longer, and it can be challenging just to keep up with the many phytonutrients provided by this popular food.

Organized according to science-based categories, the list below will give you a general idea of the phytonutrient richness of grapes. While a single grape variety is unlikely to contain all of the phytonutrients listed below, grapes as a group have been shown to provide us with the following health-supportive nutrients:

- Stilbenes
    - resveratrol
    - piceatannol
    - pterostilbene
- Flavanols
    - catechins
    - epicatechins
    - procyanidins
    - proanthocyanidins
    - viniferones
- Flavonols
    - quercetin
    - kaempferol
    - myricetin
    - isorhamnetin
- Phenolic Acids
    - caffeic acid
    - coumaric acid
    - ferulic acid
    - gallic acid
- Carotenoids
    - beta-carotene
    - lutein
    - zeaxanthin

In addition to the above-listed nutrients, grapes have also been shown to contain the hormone and antioxidant melatonin as well as unique oligopeptides (small protein-like molecules) that have anti-bacterial and other properties.

With their overwhelming number of health-supportive phytonutrients, it is not surprising that grapes have been shown to provide many of our body systems with predictable benefits. Areas of benefit in grape research include the cardiovascular system, respiratory system, immune system, inflammatory system, blood sugar regulating system, and nervous system.

Another area of special benefit is cancer prevention, with risk of breast, prostate, and colon cancer emerging as the most likely areas of grape anti-cancer benefits. The following paragraphs will give you a closer look at some key areas of health research on grapes.

Antioxidant Benefits

The wealth of antioxidant nutrients in grapes is somewhat startling! In addition to providing us with conventional antioxidant nutrient like vitamin C and manganese, grapes are filled with antioxidant phytonutrients that range from common carotenoids like beta-carotene to unusual stilbenes like resveratrol, and the total number of different antioxidant nutrients in grapes runs well into the hundreds. (Even the hormone melatonin has been identified in grapes and is known to act as an antioxidant provided by this food.) It's important to note that the seed and the skin contain the richest concentration of antioxidants. It's very rare to find a higher concentration of an antioxidant in the fleshy part of the grape than is present in the seed or skin. For this reason, most of the health research on grape antioxidants has not been conducted on whole grapes. Instead, this research has been conducted on grape skin, grape skin extract, grape seed, grape seed extract, or on grape extracts that contain skin and seed and flesh. As a general rule, the flesh of the grape contains approximately 1/20th-1/100th of the total antioxidant capacity of the seed or the skin.

The greater concentration of antioxidants in the skin and seed of grapes does not mean that we don't benefit from eating the whole grape, including the flesh! But it does mean that we need to treat grape studies as a whole as most likely reflecting stronger short-term antioxidant benefits than would be associated with short-term intake of whole grapes.

Research on antioxidant benefits provided by grapes or grape components includes the following findings. Grapes and grape components can:

- help prevent certain oxygen-related enzymes from becoming overactive. These enzymes include xanthine oxidase and catalase.
- increase our blood levels of glutathione (a critical antioxidant nutrient) and also increase the ratio of reduced-to-oxidized glutathione (one important measure of antioxidant capacity).
- help protect cell membranes from free radical damage.
- lower levels of oxygen reactive molecules in our blood.
- reduce oxidation of fat (lipid peroxidation).
- lower biomarkers of oxidative stress.

Anti-Inflammatory Benefits

Along with their strong antioxidant support, grapes provide us with equally strong anti-inflammatory benefits. Once again, research studies in this area have seldom involved dietary intake of whole grapes, but rather supplemental intake of grape components or grape extracts. Still, we have every reason to believe that these same anti-inflammatory benefits are offered by whole, fresh grapes, perhaps just not to the same extent in a short-term situation (like the few weeks or months that characterize most research studies). It's important to remember that we can enjoy grapes over a lifetime!

Grapes have been determined to lower our risk of excessive and unwanted inflammation in a variety of ways. Many pro-inflammatory messaging molecules can have their activity level reduced by grape intake. These molecules include interleukin 6 (IL-6), interleukin 1-beta (IL-1B), and tumor necrosis factor alpha (TNF-alpha). Overproduction of the pro-inflammatory enzymes cyclo-oxygenase 1 and 2 (COX-1 and COX-2) is also less likely following intake of grape components.

Cardiovascular Benefits

No body system is better situated to reap the benefit of antioxidants and anti-inflammatory molecules in grapes than the cardiovascular system. All cells in our blood need protection from potential oxygen damage (especially in our arteries where oxygen concentration in our blood is especially high). Our blood vessel linings also need strong antioxidant support. Chronic inflammation in our cardiovascular system is also a primary concern for many types of cardiovascular disease, and optimal regulation of inflammatory system activity is especially important in lowering our risk of atherosclerosis and other conditions.

The list of cardio benefits provided by grapes and grape components is perhaps the most impressive of all grape benefits. It's also one of the reasons that consumption of grapes in the form of red wine has been regarded by some researchers as a key for understanding "the French Paradox." The French Paradox refers to research observations about heart health in the French population in relationship to their saturated fat intake. Despite eating fairly large amounts of saturated fat in their overall diet, the French population as a whole has been observed to have much lower levels of heart disease than would be expected with high saturated fat intake. One of the reasons might be the anti-inflammatory (and antioxidant) support provided to their cardiovascular system on a regular basis by red wine. The idea that red wine (from red grapes) could help explain the French Paradox is just one more reason for us to consider grapes as a great addition to a heart healthy diet.

All of the following cardio benefits have been demonstrated in research studies on grapes and grape components:

- better blood pressure regulation, including blood pressure reduction if high
- better total cholesterol regulation, including total cholesterol reduction if high
- reduced LDL cholesterol levels
- reduced LDL oxidation
- reduced levels of reactive oxygen molecules in the blood
- reduced likelihood of cell adhesion to the blood vessel walls
- less clumping together of platelet cells, when inappropriate
- enhanced release of nitric oxide from endothelial cells lining the blood vessel walls in situations where vasodilation is needed
- better inflammatory regulation in the blood
- increase levels of glutathione in the blood

Blood Sugar Benefits

In terms of blood sugar regulation, not all fruits are created equal. Watermelon, for example, has a relatively high glycemic index (GI) value in the range of 70-75, and is not considered to be a food that can be freely eaten by persons having difficulty with blood sugar balance. Grapes, on the other hand, have long been classified as a low glycemic index (GI) food, with GI values ranging between 43-53. In the case of grapes, recent studies have also shown that the low GI value of grapes is a good indicator of this fruit's blood sugar benefits. Studies have now connected grape intake to better blood sugar balance, better insulin regulation, and increased insulin sensitivity. We suspect that the strong phytonutrient content of grapes plays a key role in providing these blood sugar-related benefits.

Anti-Aging and Longevity Benefits

Several grape phytonutrients may play a role in longevity and may provide us with anti-aging benefits. Best-studied in this area of health benefits is resveratrol (a stilbene phytonutrient presently mostly in grape skins, but also in grape seeds and grape flesh). Resveratrol has recently been shown to increase expression of three genes all related to longevity. (These three genes are SirT1s, Fox0s, and PBEFs.) Interestingly, some researchers have shown a parallel between activation of these longevity genes by resveratrol and activation by calorie-restricted diets. (In aging and longevity research, our ability to get optimal nutrition for the fewest possible amount of calories is related to our longevity, and the more we can decrease our calories while staying optimally nourished, the better our chances of healthy aging and longevity.)

Cognitive Benefits

Several recent studies on grape extract intake by animals, as well as grape juice intake by humans, suggest that grapes may provide us with some important cognitive benefits. For example, daily consumption of Concord grape juice in a 1-2 cup amount over a period of several months has been shown to improve the scores of study participants on the California Verbal Learning Test. Other studies on animals have shown that excessive accumulation of reactive oxygen species (ROS) in the brain can be prevented with intake of grape extracts, as can excessive accumulation of beta-amyloid protein in the hippocampus region of the brain. Synthesis of pro-inflammatory messaging molecules in the brain (including IL-6, IL-1B, and TNF-alpha) has also been shown to be reduced by intake of grape extracts. While large-scale human studies are needed to confirm these potential benefits, we expect that grape benefits for our cognitive health will be confirmed in future research.

Anti-Microbial Benefits

Numerous grape phytonutrients have been shown to have anti-microbial properties. These phytonutrients range from common flavonoids like quercetin to less common stilbenes like piceatannol and resveratrol. Recent studies have determined that grapes may also contain unique sets of oligopeptides (short protein-like molecules) that have anti-microbial properties. Exactly how we benefit from these anti-microbial substances in grapes is not yet known. But researchers have begun to speculate about their possible role in helping us prevent microbe-related problems like food-borne illness. While research in this area is clearly in its early stages, it will be interesting to see whether diets that are rich in grapes (or grape products like red wine) turn out to be associated with reduced risk of microbe-related problems like food-borne illness.

Anti-Cancer Benefits

The antioxidant and anti-inflammatory properties of grapes make them a natural for protection against cancer because chronic oxidative stress and chronic inflammation can be key factors in the development of cancer. If our cells get overwhelmed by oxidative stress (damage to cell structure and cell function by overly reactive oxygen-containing molecules) and chronic excessive inflammation, our risk of cell cancer is increased. By providing us with rich supplies of antioxidant and anti-inflammatory nutrients, grapes can help us avoid this dangerous combination of chronic oxidative stress and chronic inflammation.

Research on grapes, grape components and cancer has focused on three cancer types: breast cancer, colon cancer, and prostate cancer. In the case of breast cancer, the grape phytonutrients receiving the most research attention have been the catechins, proanthocyanidins, and stilbenes (especially resveratrol). For colon cancer, more research attention has been focused on grape flavonoids and grape anthocyanins. (This research tendency may mean that dark purple, red, and black grapes could end up being better choices for colon cancer prevention than green grapes, even though the jury is still out in this area.) One interesting development in the research on grapes and colon cancer prevention has involved studies on GADF, or grape antioxidant dietary fiber. While GADF is a proprietary product that may eventually be sold in the marketplace as a dietary supplement, the idea that grape fiber and grape antioxidants combine to provide our colon with special support makes perfect sense. Fiber is greatly needed for a healthy colon, and grapes provide us with approximately 1 gram of fiber in every 60 calories. Antioxidants are also needed, and grapes come through strong in the antioxidant category. This antioxidant-plus-fiber combination may be one of the reasons that colon cancer prevention has jumped out in health research on grapes. In the area of prostate cancer, it is the stilbenes (including resveratrol) have been the major focus in research on the anti-cancer properties of grapes.

Description

While table, wine, and raisin grapes come from the same family (*Vitaceae*) and genus (*Vitis*) of plant, there are about 60 different species of this plant type, and within these 60 species, there are literally thousands of grape varieties. (In the country of Italy, for example, more than 1,000 varieties of wine grapes are found in hillside vineyards.) Table grape varieties are most often larger in size, have been propagated to be seedless, and have relatively thin skins. Wine grapes are usually smaller in size, contain seeds, and have relatively thick skins. (Among several different types of benefits, the thicker skin of the wine grapes helps provide the wine with a richer aroma.) All types of grapes come in a variety of colors. While green, red, and black are the most commonly consumed color varieties in the U.S., grape colors also include amber/yellow, blue black, crimson, pink, and purple. (Although you may also hear the color "white" being used to refer to grapes, "white grapes" are actually green in color.)

While we often think about the Mediterranean as the home for all grapes, this amazing food is actually native to many parts of the world, including regions in Asia, Africa, and North America. From a botanical standpoint, one of the most widely cultivated table and wine grapes is *Vitis vinifera* (Common Grape Vine), and several thousand varieties of this grape exist across Europe. In the United States, native species of *Vitis* grapes include *Vitis labrusca* (which includes the Concord grape) and *Vitis rotundifolia* (which includes the muscadine grapes). In Asia, one native grape that is widely-cultivated is *Vitis amurensis* (the Amur grape). From a commercial standpoint, grape varieties from around the world have now been hybridized to produce unique blends of flavor, texture, and environmental suitability.

There has been a good bit of confusion—especially on the internet—about seedless grapes and their production. Many websites mistakenly assume that seedless grapes have been genetically modified. While agricultural researchers are definitely exploring genetically modified grape varieties and while genetically engineered (GE) grapes do exist, they are very rare in the marketplace. Some seedless varieties of grapes are the result of natural mutations, and these varieties can be vegetatively propagated to allow for commercial production. Other grape varieties will produce seedless fruit if pollination is withheld. Still other varieties of seedless grapes can be produced by crossbreeding or grafting. None of these methods involves direct manipulation of the grape plant's genetic material. With many foods, purchase of a certified organic version is one of your best ways to avoid a genetically modified version. In the case of grapes, even though we strongly recommend the organic version for a variety of reasons, avoidance of GE is not one of them. You're unlikely to get GE grapes even if you are purchasing conventionally grown varieties.

Raisins

Raisins are made from dehydrating grapes in a process that either involves the heat of the sun or a mechanical process of oven drying. Among the most popular types of raisins are Sultana, Malaga, Monukka, Zante Currant, Muscat, and Thompson seedless.

While raisins can be a good addition to a Healthiest Way of Eating, it's important not to see them as a substitute for grapes. That's because dehydration not only reduces the grapes' water content but also increases their concentration of sugar and calories. With these changes, the grapes lose their nutrient richness: in every ounce of raisins, you end up getting four times the amount of sugar and calories that you would be getting in an ounce of grapes, even though you aren't getting any more vitamins and minerals. Additionally, even though raisins are made from grapes, it's not possible to generalize the health benefits shown in research studies on grapes and their components to raisins.

That said, raisins can make a healthful contribution to snacks, cereals, salads, and other recipes. Eating them in moderation is best, given that one-quarter cup contains over 100 calories and the glycemic index rating for raisins is medium rather than low. By comparison, you get to enjoy one full cup of grapes for the same number of calories, with grapes qualifying as a low glycemic index food.

History

Grapes have a long and abundant history. While they've grown wild since prehistoric times, evidence suggests they were cultivated in Asia as early as 5000 BC. The grape also played a role in numerous biblical stories, being referred to as the "fruit of the vine." Grapes were also pictured in hieroglyphics in ancient Egyptian burial tombs. During the ancient Greek and Roman civilizations, grapes were revered for their use in winemaking. They were planted in the Rhine Valley in Germany, a place of notable wine production, in the 2nd century AD. Around this time, over 90 varieties of grapes were already known.

Even though grapes are known to have grown wild on many continents - including Europe, Asia, Africa, and North America - travel and exploration (together with a cultural fondness for this food and its wines) led to transport of native grapes across the world. For example, as European travelers explored the globe, they brought native European ("old World") grapes with them. Grapes were planted in the United States as early as the 17th century at Spanish missions in the Southwest. They also found a lasting home in the central valley of California where climate, and the relative absence of grape-preying insects, helped support their production.

In the United States, well over 90% of all commercially grown table grapes come from California, where over 700,000 acres of grapes (including table, wine, and raisin grapes) are in cultivation. Nearly 2 billion pounds of table grapes come from these 700,000 acres each year! Early in the year, from January to April, U.S. consumers depend upon imported grapes, including imports from South American countries like Chile. During May and June, imported Mexican grapes are widely available. After June, California grape production takes over the commercial marketplace in the U.S.

Worldwide, about 30,000 square miles of land are planted with grapes, resulting in the annual production of 150 trillion pounds of grapes. Grape production in five countries—Italy, China, Spain, and France—accounts for about half of all commercial production, and about one-third of all world vineyards are found in the three countries of Italy, Spain, and France. Other important grape-producing countries include Turkey, Chile, Argentina, Iran, South Africa, and Australia.

How to Select and Store

For the best tasting grapes with high concentrations of antioxidants select those that are fully ripe. Fully ripened grapes are plump and free from wrinkles. They should be intact, firmly attached to a healthy looking stem, and not leaking juice. The area around the attachment should have the same color as the rest of the grape.

One way to help predict the sweetness of grapes is by their color: green grapes are medium sweet, red grapes are very sweet, and blue-black grapes are the least sweet. Green grapes should have a slight yellowish hue, red grapes should be mostly red, while purple and blue-black grapes should be deep and rich in color.

Since grapes tend to spoil and ferment at room temperature, they should always be stored in the refrigerator. Loosely wrap unwashed grapes in a paper towel and place them in an airtight container or plastic bag. This way, they'll keep fresh in the refrigerator for up to 5 days.

While freezing detracts from some of their flavor, frozen grapes are a wonderful snack and particularly intriguing to children. To freeze grapes, wash and pat them dry, then arrange in a single layer on a cookie sheet and place in freezer. (Patting the grapes dry is important, because excess moisture can cause the grapes to stick together and become one large frozen fruit clump.) Once frozen, transfer grapes to a heavy plastic bag and return them to the freezer.

How to Enjoy

A Few Quick Serving Ideas

- Grapes are a wonderful addition to any fruit salad. For an enhanced visual effect, consider using a few different varieties of grapes.
- Give your curries a fruity punch by including fresh grapes in the recipe.
- Add grapes to mixed green salads.
- Grapes are great served with cheese as a snack or within a green salad.

WHFoods Recipes That Feature Grapes

- Yogurt with Fruit
- 10-Minute Fruit & Cheese Salad
- Grape and Arugula Salad
- Grape and Melon Salad
- 5-Minute Grapes in Honey-Lemon Sauce
- Ginger Yogurt with Fruit

Safety

If you are drinking grape juice for health benefits, avoid products labeled as grape "drinks." This is often an imitation high-sugar product with little real grape juice.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Grapes, fresh
1.00 cup
151.00 grams

Calories: 104
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin K	22.05 mcg	25	4.2	very good
copper	0.19 mg	21	3.6	very good
vitamin B2	0.11 mg	8	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Kiwifruit

Packed with more vitamin C than an equivalent amount of orange, the bright green flesh of the kiwifruit speckled with tiny black seeds adds a dramatic tropical flair to any fruit salad. California kiwifruit is available November through May, while the New Zealand crop hits the market June through October making fresh kiwis available year round.

The kiwifruit is a small fruit approximately 3 inches long and weighing about four ounces. Its green flesh is almost creamy in consistency with an invigorating taste reminiscent of strawberries, melons and bananas, yet with its own unique sweet flavor.

Kiwifruit, fresh
1.00 2 inches
(69.00 grams)

Calories: 42
GI: low

Nutrient	DRI/DV
vitamin C	85%
vitamin K	31%
copper	10%
fiber	8%
vitamin E	7%
potassium	6%
manganese	4%
folate	4%

Health Benefits

Kiwifruit can offer a great deal more than an exotic tropical flair in your fruit salad. These emerald delights contain numerous phytonutrients as well as well known vitamins and minerals that promote your health.

Kiwi's Phytonutrients Protect DNA

In the world of phytonutrient research, kiwifruit has fascinated researchers for its ability to protect DNA in the nucleus of human cells from oxygen-related damage. Researchers are not yet certain which compounds in kiwi give it this protective antioxidant capacity, but they are sure that this healing property is not limited to those nutrients most commonly associated with kiwifruit, including its vitamin C or beta-carotene content. Since kiwi contains a variety of flavonoids and carotenoids that have demonstrated antioxidant activity, these phytonutrients in kiwi may be responsible for this DNA protection.

The protective properties of kiwi have been demonstrated in a study with 6- and 7-year-old children in northern and central Italy. The more kiwi or citrus fruit these children consumed, the less likely they were to have respiratory-related health problems including wheezing, shortness of breath, or night coughing. These same antioxidant protective properties may have been involved in providing protection for these children.

Premier Antioxidant Protection

Kiwifruit emerged from our food ranking system as an excellent source of vitamin C. This nutrient is the primary water-soluble antioxidant in the body, neutralizing free radicals that can cause damage to cells and lead to problems such as inflammation and cancer. In fact, adequate intake of vitamin C has been shown to be helpful in reducing the severity of conditions like osteoarthritis, rheumatoid arthritis, and asthma, and for preventing conditions such as colon cancer, atherosclerosis, and diabetic heart disease. And since vitamin C is necessary for the healthy function of the immune system, it may be useful for preventing recurrent ear infections in people who suffer from them. Owing to the multitude of vitamin C's health benefits, it is not surprising that research has shown that consumption of vegetables and fruits high in this nutrient is associated with a reduced risk of death from all causes including heart disease, stroke and cancer.

Fiber for Blood Sugar Control Plus Cardiovascular and Colon Health

Our food ranking system also qualified kiwifruit as a very good source of dietary fiber. The fiber in kiwifruit has also been shown to be useful for a number of conditions. Researchers have found that diets that contain plenty of fiber can reduce high cholesterol levels, which may reduce the risk of heart disease and heart attack. Fiber is also good for binding and removing toxins from the colon, which is helpful for preventing colon cancer. In addition, fiber-rich foods, like kiwifruit, are good for keeping the blood sugar levels of diabetic patients under control.

Kiwifruit also passed our food ranking test as a good source of the mineral potassium.

Protection against Asthma

Eating vitamin C-rich fruit such as kiwi may confer a significant protective effect against respiratory symptoms associated with asthma such as wheezing.

A study published in *Thorax* that followed over 18,000 children aged 6-7 years living in Central and Northern Italy found that those eating the most citrus and kiwifruit (5-7 servings per week) had 44% less incidence of wheezing compared to children eating the least (less than once a week). Shortness of breath was reduced by 32%, severe wheeze by 41%, night time cough by 27%, chronic cough by 25%, and runny nose by 28%.

Children who had asthma when the study began appeared to benefit the most, and protective effects were evident even among children who ate fruit only once or twice a week.

Protection against Macular Degeneration

Your mother may have told you carrots would keep your eyes bright as a child, but as an adult, it looks like fruit is even more important for keeping your sight. Data reported in a study published in the Archives of Opthamology indicates that eating 3 or more servings of fruit per day may lower your risk of age-related macular degeneration (ARMD), the primary cause of vision loss in older adults, by 36%, compared to persons who consume less than 1.5 servings of fruit daily.

In this study, which involved over 110,000 women and men, researchers evaluated the effect of study participants' consumption of fruits; vegetables; the antioxidant vitamins A, C, and E; and carotenoids on the development of early ARMD or neovascular ARMD, a more severe form of the illness associated with vision loss. Food intake information was collected periodically for up to 18 years for women and 12 years for men. While, surprisingly, intakes of vegetables, antioxidant vitamins and carotenoids were not strongly related to incidence of either form of ARM, fruit intake was definitely protective against the severe form of this vision-destroying disease. Three servings of fruit may sound like a lot to eat each day, but kiwifruit can help you reach this goal. Slice kiwi over your morning cereal, lunch time yogurt or green salads. For a more elegant meal, decorate any fish dish or fruit salad with kiwi slices.

A Delicious Way to Enjoy Cardiovascular Health

Enjoying just a couple of kiwifruit each day may significantly lower your risk for blood clots and reduce the amount of fats (triglycerides) in your blood, therefore helping to protect cardiovascular health.

Unlike aspirin, which also helps to reduce blood clotting but has side effects such as inflammation and bleeding in the intestinal tract, the effects of regular kiwi consumption are all beneficial. Kiwifruit is an excellent source of vitamin C, and polyphenols, and a good source of potassium, all of which may function individually or in concert to protect the blood vessels and heart. In one study, human volunteers who ate 2 to 3 kiwifruit per day for 28 days reduced their platelet aggregation response (potential for blood clot formation) by 18% compared to controls eating no kiwi. In addition, kiwi eaters' triglycerides (blood fats) dropped by 15% compared to controls.

Description

The kiwifruit is a little fruit holding great surprises. The most common species of kiwifruit is *Actinidia deliciosa*, commonly known as Hayward kiwi. Inside of this small, oval-shaped fruit featuring brown fuzzy skin resides a brilliant, semi-translucent emerald green flesh speckled with a few concentrically arranged white veins and small black seeds. Its flesh is almost creamy in consistency with an invigorating taste reminiscent of a mixture of strawberries and bananas, yet with its own unique sweet flavor.

With the growing interest in kiwifruit, other species are now becoming more widely available. These include the hardy kiwi and the silvervine kiwi, two smooth-skinned varieties that are the size of cherries and whose flesh has a golden yellow-green hue.

History

The kiwifruit is a fruit with a very interesting history and whose recent rise in popularity reflects a combination of an appreciation for its taste, nutritional value, unique appearance and, surprisingly, its changing name.

Native to China, kiwifruits were originally known as Yang Tao. They were brought to New Zealand from China by missionaries in the early 20th century with the first commercial plantings occurring several decades later. In 1960, they were renamed Chinese Gooseberries.

In 1961, Chinese Gooseberries made their first appearance at a restaurant in the United States and were subsequently "discovered" by an American produce distributor who felt that the U.S. market would be very receptive to this uniquely exotic fruit. She initiated the import of these fruits into the United States in 1962, but to meet what was felt to be burgeoning demand, changed its name from Chinese Gooseberry to kiwifruit, in honor of the native bird of New Zealand, the kiwi, whose brown fuzzy coat resembled the skin of this unique fruit. Currently, Italy, New Zealand, Chile, France, Japan and the United States are among the leading commercial producers of kiwifruit.

How to Select and Store

When selecting kiwifruits, hold them between your thumb and forefinger and gently apply pressure; those that have the sweetest taste will yield gently to pressure. Avoid those that are very soft, shriveled or have bruised or damp spots. As size is not related to the fruit's quality, choose a kiwifruit based upon your personal preference or recipe need. Kiwifruits are usually available throughout most of the year.

If kiwifruits do not yield when you gently apply pressure with your thumb and forefinger, they are not yet ready to be consumed since they will not have reached the peak of their sweetness. Kiwifruits can be left to ripen for a few days to a week at room temperature, away from exposure to sunlight or heat. Placing the fruits in a paper bag with an apple, banana or pear will help to speed their ripening process. Ripe kiwifruits can be stored either at room temperature or in the refrigerator. For the most antioxidants, consume fully ripened kiwifruit.

How to Enjoy

A Few Quick Serving Ideas:

- Kiwifruit are so delicious, they can be eaten as is. One of our favorite ways to do so is to peel with a paring knife and slice.
- Add kiwifruit to tossed green salads.
- Serve sliced kiwifruit and strawberries, fruits whose flavors are naturally complementary, topped with yogurt.
- Mix sliced kiwifruit, orange and pineapple together to make chutney that can be served as an accompaniment to chicken or fish.
- Blend kiwifruit and cantaloupe in a food processor to make a chilled soup. For a creamier consistency, blend yogurt in with the fruit mixture.
- Kiwifruit have a wonderful flavor and appearance for use in fruit tarts.

For some of our favorite recipes, click Recipes.

Safety

Kiwifruit and Latex-Fruit Syndrome

Latex-fruit syndrom is a health problem related to the possible reaction of our immune system to certain proteins found in natural rubber (from the tree *Hevea brasiliensis*) and highly similar proteins found in certain foods, such as kiwifruit. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Kiwifruit, fresh **1.00 2 inches** **69.00 grams**				**Calories: 42** **GI: low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin C	63.96 mg	85	36.5	excellent
vitamin K	27.81 mcg	31	13.2	excellent
copper	0.09 mg	10	4.3	very good
fiber	2.07 g	8	3.5	very good
vitamin E	1.01 mg (ATE)	7	2.9	good
potassium	215.28 mg	6	2.6	good
folate	17.25 mcg	4	1.8	good
manganese	0.07 mg	4	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Lemon/Limes

Although lemons and limes may not be what you would choose for an afternoon snack, we consider them as powerhouses when we want to bring out the flavor of other foods. While both are available throughout the year, lemons are in the peak of their season around May, June and August while limes are at their peak from May through October.

Lemons are oval in shape and feature a yellow, texturized outer peel. Like other citrus fruits, their inner flesh is encased in eight to ten segments.

Usually smaller than lemons, limes are oval or round in shape having a diameter of one to two inches with green flesh and skin. They can be either sour or sweet depending on the variety; however, sweet limes are not readily available in the United States. Sour limes contain citric acid giving them an acidic and tart taste, while sweet limes lack citric acid and are sweeter in flavor.

Lemons and Limes, fresh juice
0.25 cup
(61.00 grams)

Calories: 13
GI: low

Nutrient	DRI/DV
vitamin C	31%
folate	3%

Health Benefits

Phytonutrients with Antioxidant and Antibiotic Effects

Like many of the fruits and vegetables featured on our website, lemons and limes contain unique flavonoid compounds that have antioxidant and anti-cancer properties. Of special interest in limes have been flavonoids called *flavonol glycosides*, including many *kaempferol*-related molecules. While these flavonoids have been shown to stop cell division in many cancer cell lines, they are perhaps most interesting for their antibiotic effects. In several villages in West Africa where cholera epidemics had occurred, the inclusion of lime juice during the main meal of the day was determined to have been protective against the contraction of cholera. (Cholera is a disease triggered by activity of the bacteria called *Vibrio cholera*). Researchers quickly began to experiment with the addition of lime juice to the sauce eaten with rice, and in this role, lime juice was also found to have a strong protective effect against cholera.

Several other fascinating research studies on the healing properties of lemons and limes have shown that cell cycles—including the decision a cell makes about whether to divide (called *mitosis*) or die (*apoptosis*—are altered by lime juice, as are the activities of special immune cells called *monocytes*.

In addition to their unique phytonutrient properties, lemons and limes are an excellent source of vitamin C, one of the most important antioxidants in nature. Vitamin C is one of the main antioxidants found in food and the primary water-soluble antioxidant in the body. Vitamin C travels through the body neutralizing any free radicals with which it comes into contact in the aqueous environments in the body both inside and outside cells. Free radicals can interact with the healthy cells of the body, damaging them and their membranes, and also cause a lot of inflammation, or painful swelling, in the body. This is one of the reasons that vitamin C has been shown to be helpful for reducing some of the symptoms of osteoarthritis and rheumatoid arthritis.

Since free radicals can damage blood vessels and can change cholesterol to make it more likely to build up in artery walls, vitamin C can be helpful for preventing the development and progression of atherosclerosis and diabetic heart disease.

Vitamin C is also vital to the function of a strong immune system. The immune system's main goal is to protect you from illness, so a little extra vitamin C may be useful in conditions like colds, flus, and recurrent ear infections.

Owing to the multitude of vitamin C's health benefits, it is not surprising that research has shown that consumption of vegetables and fruits high in this nutrient is associated with a reduced risk of death from all causes including heart disease, stroke and cancer.

Limonins Support Optimal Health

In animal studies and laboratory tests with human cells, compounds in citrus fruits, including lemons and limes, called limonoids have been shown to help fight cancers of the mouth, skin, lung, breast, stomach and colon. Now, scientists from the US Agricultural Research Service (ARS) have shown that our bodies can readily absorb and utilize a very long-acting limonoid called limonin that is present is citrus fruits in about the same amount as vitamin C.

In citrus fruits, limonin is present in the form of limonin glucoside, in which limonin is attached to a sugar (glucose) molecule. Our bodies easily digest this compound, cleaving off the sugar and releasing limonin.

In the ARS study, 16 volunteers were given a dose of limonin glucoside in amounts ranging from those that would be found in from 1 to 7 glasses of orange juice. Blood tests showed that limonin was present in the plasma of all except one of the subjects, with concentrations highest within 6 hours after consumption. Traces of limonin were still present in 5 of the volunteers 24 hours after consumption!

Limonin's bioavailability and persistence may help explain why citrus limonoids are potent anti-carcinogens that may prevent cancerous cells from proliferating. Other natural anti-carcinogens are available for much less time; for example, the phenols in green tea and chocolate remain active in the body for just 4 to 6 hours.

The ARS team are now investigating the potential cholesterol-lowering effects of limonin. Lab tests indicate that human liver cells produce less apo B when exposed to limonin. Apo B is a structural protein that is part of the LDL cholesterol molecule and is needed for LDL production, transport and binding, so higher levels of apo B translate to higher levels of LDL cholesterol.

Protection against Rheumatoid Arthritis

While one study suggests that high doses of supplemental vitamin C makes osteoarthritis, a type of degenerative arthritis that occurs with aging, worse in laboratory animals, another indicates that vitamin C-rich foods, such as lemons and limes, provide humans with protection against inflammatory polyarthritis, a form of rheumatoid arthritis involving two or more joints.

The findings, presented in the *Annals of the Rheumatic Diseases* were drawn from a study of more than 20,000 subjects who kept diet diaries and were arthritis-free when the study began, and focused on subjects who developed inflammatory polyarthritis and similar subjects who remained arthritis-free during the follow-up period. Subjects who consumed the lowest amounts of vitamin C-rich foods were more than three times more likely to develop arthritis than those who consumed the highest amounts.

Description

Lemons

Lemons, scientifically known as *Citrus limon*, are more commonly known as the fruit that evokes images of sunshine and the sweet smiles of children standing roadside at their homemade lemonade stands.

Lemons are oval in shape and feature a yellow, texturized outer peel. Like other citrus fruits, their inner flesh is encased in segments, with the average lemon having eight to ten.

While most lemons are tart, acidic and astringent, they are also surprisingly refreshing. The two main types of sour lemons are the Eureka and the Lisbon. The Eureka generally has more texturized skin, a short neck at one end and a few seeds, while the Lisbon has smoother skin, no neck and is generally seedless. In addition to these sour lemons, there are also some varieties that are sweet in flavor. One notable example is the Meyer lemon that is becoming more popular in both markets and restaurants.

Limes

Limes are a small citrus fruit, *Citrus aurantifolia*, whose skin and flesh are green in color and which have an oval or round shape with a diameter between one to two inches. Limes can either be sour or sweet, with the latter not readily available in the United States. Sour limes possess a greater sugar and citric acid content than lemons and feature an acidic and tart taste, while sweet limes lack citric acid content and are sweet in flavor.

There are two general varieties of sour limes available, the Tahitian and the Key. Among Tahitian limes are the egg-shaped Persian and the smaller, seedless Bearss. Key limes, famous for the pie bearing their name, are smaller and more acidic than the Tahitian variety.

History

Lemons

Lemons were originally developed as a cross between the lime and the citron and are thought to have originated in China or India, having been cultivated in these regions for about 2,500 years. Their first introduction to Europe was by Arabs who brought them to Spain in the 11th century around the same time that they were introduced into Northern Africa. The Crusaders, who found the fruit growing in Palestine, are credited with bringing the lemon to other countries across Europe. Like many other fruits and vegetables, lemons were brought to the Americas by Christopher Columbus in his second voyage to the New World in 1493, and have been grown in Florida since the 16th century.

Lemons, like other vitamin-C rich fruits, were highly prized by the miners and developers during the California Gold Rush in the mid-19th century, since they were used to protect against the development of scurvy. They were in such demand that people were willing to pay up to $1 per lemon, a price that would still be considered costly today and was extremely expensive back in 1849. The major producers of lemons today are the United States, Italy, Spain, Greece, Israel and Turkey.

Limes

Limes are grown on trees that flourish in tropical and subtropical climates. They were thought to originate in Southeast Asia. Arab traders brought lime trees back from their journey to Asia and introduced them into Egypt and Northern Africa around the 10th century. The Arabian Moors brought them to Spain in the 13th century and then, like many fruits, they were spread throughout southern Europe during the Crusades.

Limes made their way to the New World with Columbus on his second voyage in 1493, and were subsequently planted in many Caribbean countries whose hot, humid climates supported the cultivation of this fruit. Centuries later, British explorers and traders, who were readily using the vitamin C-rich limes that grew in their West Indies colonies to prevent scurvy, earned the nickname "limey," a word that is often still used colloquially for persons of British descent.

The introduction of limes to the United States began in the 16th century when Spanish Explorers brought the West Indies lime to the Florida Keys, beginning the advent of Key limes. In the following century, Spanish missionaries attempted to plant lime trees in California, but the climate did not support their growth. In great demand by the miners and explorers during the California Gold Rush as a fruit that was known to prevent scurvy, limes began to be imported from Tahiti and Mexico at this time in the mid-19th century. Today, Brazil, Mexico and the United States are among the leading commercial producers of limes.

How to Select and Store

Lemons

One of the tricks to finding a good quality lemon is to find one that is rather thin-skinned since those with thicker peels will have less flesh and therefore be less juicy. Therefore, choose lemons that are heavy for their size and that feature peels that have a finely grained texture. They should be fully yellow in color as those that have green tinges will be more acidic due to the fact that they have not fully ripened. Signs of overmature fruit include wrinkling, soft or hard patches and dull coloring. Fresh lemons are available all year round.

Lemons will stay fresh kept at room temperature, away from exposure to sunlight, for about one week. If you will not be using them within this time period, you can store the lemons in the refrigerator crisper where they will keep for about four weeks.

Lemon juice and zest can also be stored for later use. Place freshly squeezed lemon juice in ice cube trays until frozen, subsequently storing them in plastic bags in the freezer. Dried lemon zest should be stored in a cool and dry place in an airtight glass container.

Limes

Choose limes that are firm and heavy for their size, free of decay and mold. They should have a glossy skin that is deep green in color; although limes turn more yellow as they ripen, they are at the height of their lively, tart flavor when they are green in color. While brown spots on the skin of limes may not affect their color, limes that are mostly brownish in color should be avoided since this may be an indication that they have "scald" which may cause them to have an undesirable moldy taste.

Limes are available in the marketplace throughout the year, although they are usually in greater supply from mid-spring through mid-fall.

Limes can be kept out at room temperature where they will stay fresh for up to one week. Make sure to keep them away from sunlight exposure since it will cause them to turn yellow and will alter their flavor. Limes can be stored in the refrigerator crisper, wrapped in a loosely sealed plastic bag, where they will keep fresh for about 10-14 days. While they can be kept longer than that, for another several weeks, they will begin to lose their characteristic flavor.

Lime juice and zest can also be stored for later use. Place freshly squeezed lime juice in ice cube trays until frozen, subsequently storing them in plastic bags in the freezer. Dried lime zest should be stored in a cool and dry place in an airtight glass container.

How to Enjoy

A Few Quick Serving Ideas

Place thinly sliced lemons, peel and all, underneath and around fish before cooking. Baking or broiling will soften the slices so that they can be eaten along with the fish.

Combine lemon juice with olive or flax oil, freshly crushed garlic and pepper to make a light and refreshing salad dressing.

If you are watching your salt intake (and even if you are not), serve lemon wedges with meals as their tartness makes a great salt substitute.

Combine freshly squeezed lime juice, evaporated cane juice and either plain or sparkling water to make limeade.

Add an-easy-to-prepare zing to dinner tonight by tossing seasoned cooked brown rice with garden peas, chicken pieces, scallions, pumpkin seeds, lime juice and lime zest.

Squeeze some lime juice onto an avocado quarter and eat as is.

For some of our favorite recipes, click Recipes.

Safety

Oxalate Content

Lemon and lime peel have consistently been determined to have high oxalate content. Oxalates are naturally occurring organic acids found in a wide variety of foods, and in the case of certain medical conditions, they must be greatly restricted in a meal plan to prevent over-accumulation inside the body. Our comprehensive article about oxalates will provide you with practical and detailed information about these organic acids, food, and health.

While the peels of lemons and limes have consistently been shown to include high levels of oxalates, lemon and lime juice are actually low in this organic acid. Moreover, research suggests that lemon and lime juice might actually help prevent calcium oxalate kidney stone formation through their high citrate content. (The citrates from these juices can bind to calcium in place of oxalates, thus lowering supersaturation of the urine with calcium oxalate. In addition, the formation of citrate salts can help to raise the urine pH and further lower the risk of calcium oxalate stone formation which requires a low urine pH.

Lemons and Limes and Wax Coatings

Conventionally grown lemons and limes may be waxed to protect them from bruising during shipping. Plant, insect, animal or petroleum-based waxes may be used. Carnauba palm is the most common plant-source wax. Other compounds, such as ethyl alcohol or ethanol, are added to the waxes for consistency, milk casein (a protein linked to milk allergy) for "film formers" and soaps for flowing agents. Since you may not be able to determine the source of these waxes, this is another good reason to choose organically grown lemons and limes.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Lemons and Limes, fresh juice
0.25 cup
61.00 grams

Calories: 13
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin C	23.61 mg	31	42.2	excellent
folate	12.20 mcg	3	4.1	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Oranges

Juicy and sweet and renowned for its concentration of vitamin C, oranges make the perfect snack and add a special tang to many recipes; it is no wonder that they are one of the most popular fruits in the world. Oranges are generally available from winter through summer with seasonal variations depending on the variety.

Oranges are round citrus fruits with finely-textured skins that are, of course, orange in color just like their pulpy flesh; the skin can vary in thickness from very thin to very thick. Oranges usually range from approximately two to three inches in diameter.

Oranges, fresh
1.00 medium
(131.00 grams)

Calories: 62
GI: low

Nutrient	DRI/DV
vitamin C	93%
fiber	13%
folate	10%
vitamin B1	9%
pantothenic acid	7%
copper	7%
potassium	7%
calcium	5%

Health Benefits

Oranges' Healing Phytonutrients

In recent research studies, the healing properties of oranges have been associated with a wide variety of phytonutrient compounds. These phytonutrients include *citrus flavanones* (types of flavonoids that include the molecules *hesperetin* and *naringenin*), *anthocyanins*, *hydroxycinnamic acids*, and a variety of *polyphenols*. When these phytonutrients are studied in combination with oranges—vitamin C, the significant antioxidant properties of this fruit are understandable.

But it is yet another *flavanone* in oranges, the *herperidin* molecule, which has been singled out in phytonutrient research on oranges. Arguably, the most important *flavanone* in oranges, *herperidin* has been shown to lower high blood pressure as well as cholesterol in animal studies, and to have strong anti-inflammatory properties. Importantly, most of this phytonutrient is found in the peel and inner white pulp of the orange, rather than in its liquid orange center, so this beneficial compound is too often removed by the processing of oranges into juice.

A Healthy Dose of Vitamin C for Antioxidant Protection and Immune Support

You may already know that oranges are an excellent source of vitamin C but do you know just how important vitamin C and oranges are for good health? Vitamin C is the primary water-soluble antioxidant in the body, disarming free radicals and preventing damage in the aqueous environment both inside and outside cells. Inside cells, a potential result of free radical damage to DNA is cancer. Especially in areas of the body where cellular turnover is especially rapid, such as the digestive system, preventing DNA mutations translates into preventing cancer. This is why a good intake of vitamin C is associated with a reduced risk of colon cancer.

Free radical damage to other cellular structures and other molecules can result in painful inflammation, as the body tries to clear out the damaged parts. Vitamin C, which prevents the free radical damage that triggers the inflammatory cascade, is thus also associated with reduced severity of inflammatory conditions, such as asthma, osteoarthritis, and rheumatoid arthritis.

Free radicals also oxidize cholesterol. Only after being oxidized does cholesterol stick to the artery walls, building up in plaques that may eventually grow large enough to impede or fully block blood flow, or rupture to cause a heart attack or stroke. Since vitamin C can neutralize free radicals, it can help prevent the oxidation of cholesterol.

Vitamin C, which is also vital for the proper function of a healthy immune system, is good for preventing colds and may be helpful in preventing recurrent ear infections.

A Glass of Orange Juice More Protective than Vitamin C Alone

Consuming vitamin C supplements does not provide the same protective benefits as drinking a glass of orange juice, shows research by Italian researchers in the Division of Human Nutrition at the University of Milan, Italy (Guarnieri S, Riso P, et al., British Journal of Nutrition).

Seven healthy test subjects were given each of three drinks, two weeks apart: blood-orange juice containing 150 milligrams of vitamin C, fortified water containing 150 milligrams of vitamin C, and a sugar and water solution containing no vitamin C. Blood samples were collected immediately before the drink was consumed, then every hour for 8 hours, and finally 24 hours after consumption of each drink.

Blood samples were exposed to hydrogen peroxide, and free radical damage to DNA was evaluated at 3 and 24 hours. Only when orange juice was consumed was any protective effect seen. After drinking orange juice, DNA damage was 18% less after 3 hours, and 16% less after 24 hours. No protection against DNA damage was seen after consumption of the vitamin C fortified drink or the sugar drink.

While another study, which looked at much larger quantities of vitamin C, did show a protective effect from the vitamin alone, this research indicates that not only is the protection afforded by fruit more complex, but smaller amounts of nutrients like vitamin C are all that are needed for benefit.

Said lead researcher, Serena Guarnieri, "It appears that vitamin C is not the only chemical responsible for antioxidant protection." In oranges, vitamin C is part of a matrix involving many beneficial phytochemicals (for example, cyanidin-3-glucoside, flavanones and carotenoids)."But how they are interacting is still anyone's guess," she added. Fortunately, we don't have to wait until scientists figure this out to receive oranges' DNA-protective benefits. Practical Tip: For the best DNA protection, skip the vitamin C—fortified bottled drinks and enjoy a glass of real (preferably organic as organic foods have been shown to contain higher amounts of phytonutrients), freshly squeezed orange juice—or simply eat an orange!

Owing to the multitude of vitamin C's health benefits, it is not surprising that research has shown that consumption of vegetables and fruits high in this nutrient is associated with a reduced risk of death from all causes including heart disease, stroke and cancer.

Protection against Cardiovascular Disease

A 248-page report, "The Health Benefits of Citrus Fruits," released December 2003 by Australian research group, CSIRO (The Commonwealth Scientific and Industrial Research), reviews 48 studies that show a diet high in citrus fruit provides a statistically significant protective effect against some types of cancer, plus another 21 studies showing a non-significant trend towards protection.

Citrus appears to offer the most significant protection against esophageal, oro-phayngeal/laryngeal (mouth, larynx and pharynx), and stomach cancers. For these cancers, studies showed risk reductions of 40-50%.

The World Health Organization's recent draft report, "Diet, Nutrition and the Prevention of Chronic Disease," concludes that a diet that features citrus fruits also offers protection against cardiovascular disease due to citrus fruits—folate, which is necessary for lowering levels of the cardiovascular risk factor, homocysteine; their, potassium, which helps lower blood pressure, protecting against stroke and cardiac arrhythmias; and the vitamin C, carotenoids and flavonoids found in citrus fruits, all of which have been identified as having protective cardiovascular effects.

One large US study reviewed in the CSIRO report showed that one extra serving of fruit and vegetables a day reduced the risk of stroke by 4%, and this increased by 5-6 times for citrus fruits, reaching a 19% reduction of risk for stroke from consuming one extra serving of citrus fruit a day.

The CSIRO Report also includes evidence of positive effects associated with citrus consumption in studies for arthritis, asthma, Alzheimer's disease and cognitive impairment, Parkinson's disease, macular degeneration, diabetes, gallstones, multiple sclerosis, cholera, gingivitis, optimal lung function, cataracts, ulcerative colitis and Crohn's disease.

Finally, the CSIRO Report notes that as low fat, nutrient-rich foods with a low glycemic index, citrus fruits are protective against overweight and obesity, conditions which increase the risk of heart disease, certain cancers, diabetes, high blood pressure and stroke, and add to symptoms of other conditions like arthritis.

An orange has over 170 different phytonutrients and more than 60 flavonoids, many of which have been shown to have anti-inflammatory, anti-tumour and blood clot inhibiting properties, as well as strong antioxidant effects.

Phytonutrients, specifically, the class of polyphenols, are high in citrus with oranges containing 84mg Gallic Acid equivalents/100mg. The polyphenols so abundant in oranges have been shown to have a wide range of antioxidant, anti-viral, anti-allergenic, anti-inflammatory, anti-proliferative and anti-carcinogenic effects. Although most of the research has centered on citrus polyphenols—possible role in cancer and heart disease, more recently, scientists have begun to look at their role in brain functions such as learning and memory.

An increasing number of studies have also shown a greater absorption of the nutrients in citrus when taken not as singly as supplements, but when consumed within the fruit in which they naturally appear along with all the other biologically active phytonutrients that citrus fruits contain.

Long-Acting Liminoids in Citrus Add to Their Ability to Promote Optimal Health

In animal studies and laboratory tests with human cells, compounds in citrus fruits, including oranges, called limonoids have been shown to help fight cancers of the mouth, skin, lung, breast, stomach and colon. Now, scientists from the US Agricultural Research Service have shown that our bodies can readily absorb and utilize a very long-acting limonoid called limonin that is present is citrus fruits in about the same amount as vitamin C.

In citrus fruits, limonin is present in the form of limonin glucoside, in which limonin is attached to a sugar (glucose) molecule. Our bodies easily digest this compound, cleaving off the sugar and releasing limonin.

In the ARS study, 16 volunteers were given a dose of limonin glucoside in amounts ranging from those that would be found in from 1 to 7 glasses of orange juice. Blood tests showed that limonin was present in the plasma of all except one of the subjects, with concentrations highest within 6 hours after consumption. Traces of limonin were still present in 5 of the volunteers 24 hours after consumption!

Limonin's bioavailability and persistence may help explain why citrus limonoids are potent anti-carcinogens that may continuously prevent cancerous cells from proliferating. Other natural anti-carcinogens are available for much less time; for example, the phenols in green tea and chocolate remain active in the body for just 4 to 6 hours.

Possible Cholesterol-Lowering Benefits

The ARS team is now investigating the potential cholesterol-lowering effects of limonin. Lab tests indicate that human liver cells produce less apo B when exposed to limonin. Apo B is a structural protein that is part of the LDL cholesterol molecule and is needed for LDL production, transport and binding, so higher levels of apo B translate to higher levels of LDL cholesterol.

Compounds in Orange Peel May Lower Cholesterol as Effectively as Statin Drugs

A class of compounds found in citrus fruit peels called polymethoxylated flavones (PMFs) have the potential to lower cholesterol more effectively than some prescription drugs, and without side effects, according to a study by U.S. and Canadian researchers that was published in the *Journal of Agricultural and Food Chemistry*.

In this study, when laboratory animals with diet-induced high cholesterol were given the same diet containing 1% PMFs (mainly tangeretin), their blood levels of total cholesterol, VLDL and LDL (bad cholesterol) were reduced by 19-27 and 32-40% respectively. Comparable reductions were also seen when the animals were given diets containing a 3% mixture of two other citrus flavonones, hesperidin and naringin.

Treatment with PMFs did not appear to have any effect on levels of beneficial HDL cholesterol, and no negative side effects were seen in the animals fed the PMF-containing diets.

Although a variety of citrus fruits contain PMFs, the most common PMFs, tangeretin and nobiletin, are found in the peels of tangerines and oranges. Juices of these fruits also contain PMFs, but in much smaller amounts. In fact, you'd have to drink about 20 glasses of juice each day to receive an amount of PMFs comparable in humans to that given to the animals. However, grating a tablespoon or so of the peel from a well-scrubbed organic tangerine or orange each day and using it to flavor tea, salads, salad dressings, yogurt, soups, or hot oatmeal, buckwheat or rice may be a practical way of achieving some cholesterol-lowering benefits. The researchers are currently exploring the mechanism of action by which PMFs lower cholesterol. Based on early results in cell and animal studies, they suspect that PMFs work like statin drugs, by inhibiting the synthesis of cholesterol and triglycerides inside the liver.

A Very Good Source of Fiber

Oranges' health benefits continue with their fiber, which has been shown to reduce high cholesterol levels thus helping to prevent atherosclerosis. Fiber can also help out by keeping blood sugar levels under control, which may help explain why oranges can be a very healthy snack for people with diabetes. In addition, the natural fruit sugar in oranges, fructose, can help to keep blood sugar levels from rising too high after eating. The fiber in oranges can grab cancer-causing chemicals and keep them away from cells of the colon, providing yet another line of protection from colon cancer. And the fiber in oranges may be helpful for reducing the uncomfortable constipation or diarrhea in those suffering from irritable bowel syndrome.

In addition to oranges' phytonutrients, vitamin C, and fiber, they are a good source of folate, vitamin A (in the form of carotenoids), vitamin B1, potassium, copper, pantothenic acid, and calcium.

Prevent Kidney Stones

Want to reduce your risk of calcium oxalate kidney stones? Drink orange juice. A study published in the *British Journal of Nutrition* found that when women drank 1/2 to 1 litre of orange, grapefruit or apple juice daily, their urinary pH value and citric acid excretion increased, significantly dropping their risk of forming calcium oxalate stones.

Help Prevent Ulcers and Reduce Risk for Stomach Cancer

An orange a day may help keep ulcers away, according to a study published in the *Journal of the American College of Nutrition*. In this study, researchers evaluated data from over 6,000 adults enrolled in the Third National Health and Nutrition Examination Survey. Study participants with the highest blood levels of vitamin C had a 25% lower incidence of infection with *Helicobacter pylori* (*H. pylori*), the bacterium responsible for causing peptic ulcers and in turn, an increased risk for stomach cancer. Researchers are uncertain whether *H. pylori* lowers blood levels of vitamin C or if high blood levels of vitamin C help protect against infection—either way, eating an orange or drinking a glass of orange juice each day may help prevent gastric ulcers. Lead researcher in this study, Dr. Joel A. Simon at the San Francisco VA Medical Center, urges people who have tested positive for *H. pylori* to increase their consumption of vitamin C-rich foods since this may help them combat *H. pylori* infection.

Protect Respiratory Health

Consuming foods rich in beta-cryptoxanthin, an orange-red carotenoid found in highest amounts in oranges, corn, pumpkin, papaya, red bell peppers, tangerines, and peaches, may significantly lower one's risk of developing lung cancer. A study published in the September 2003 issue of *Cancer Epidemiology, Biomarkers and Prevention* reviewed dietary and lifestyle data collected from over 60,000 adults in Shanghai, China. Those eating the most crytpoxanthin-rich foods showed a 27% reduction in lung cancer risk. When current smokers were evaluated, those who were also in the group consuming the most cryptoxanthin-rich foods were found to have a 37% lower risk of lung cancer compared to smokers who ate the least of these health-protective foods.

Protection Against Rheumatoid Arthritis

New research published in the *American Journal of Clinical Nutrition* adds to the evidence that enjoying a daily glass of freshly squeezed orange juice can significantly lower your risk of developing rheumatoid arthritis.

Data collected by the European Prospective Investigation of Cancer Incidence (EPIC)-Norfolk study, a population-based, prospective study of over 25,000 subjects, showed that study participants with the highest daily intake of the carotenoids, zeaxanthin and beta-cryptoxanthin, had a much lower risk of developing rheumatoid arthritis compared to individuals consuming the least of these beneficial phytonutrients. Those whose intake of zeaxanthin was highest were 52% less likely to develop rheumatoid arthritis, while those with the highest intake of cryptoxanthin had a 49% reduction in risk. Pretty dramatic benefits for doing something as simple as enjoying a glass of freshly squeezed orange juice each day!

Description

Oranges are one of the most popular fruits around the world. While they are delightful as a snack or as a recipe ingredient, for many Americans, it is their juice that is most associated with good health, having a reputation for being an integral part of a healthy breakfast.

Oranges are round citrus fruits with finely-textured skins that are, of course, orange in color just like their pulpy flesh. They usually range from about two to three inches in diameter.

Oranges are classified into two general categories—sweet and bitter—with the former being the type most commonly consumed. Popular varieties of the sweet orange (*Citrus sinensis*) include Valencia, Navel and Jaffa oranges, as well as the blood orange, a hybrid species that is smaller in size, more aromatic in flavor and has red hues running throughout its flesh. Bitter oranges (*Citrus aurantium*) are oftentimes used to make jam or marmalade, and their zest serves as the flavoring for liqueurs such as Grand Marnier and Cointreau.

History

Oranges originated thousands of years ago in Asia, in the region from southern China to Indonesia from which they spread to India. Although Renaissance paintings display oranges on the table in paintings of The Last Supper, the assumption that they were grown in this region at this time seems to be erroneous since oranges were not cultivated in the Middle East until sometime around the 9th century. Sweet oranges were introduced into Europe around the 15th century by various groups including the Moors, and the Portuguese as well as the Italian traders and explorers who found them on their voyages to Asia and the Middle East.

Orange trees began to be grown in the Caribbean Islands in the late 15th century after Christopher Columbus brought the seeds there on his second voyage to the New World. Spanish explorers are responsible for bringing oranges to Florida in the 16th century, while Spanish missionaries brought them to California in the 18th century, beginning the cultivation of this citrus fruit in the two states widely known for their oranges.

Before the 20th century, oranges were very expensive and therefore they were not regularly consumed, but rather eaten on special holidays such as Christmas. After more efficient means of transportation were developed, and food processors invented methods for utilizing orange by-products such as citric acid and bioflavonoids, the price of oranges dropped, and they could be consumed on a wide scale, as they are today. Currently, the countries that are some of the largest commercial producers of oranges include the United States, Brazil, Mexico, Spain, China and Israel.

How to Select and Store

Oranges do not necessarily have to have a bright orange color to be good. In fact, the uniform color of non-organic oranges may be due to injection of Citrus Red Number 2 (an artificial dye) into their skins at the level of 2 parts per million. Whether organic or not, oranges that are partially green or have brown russetting may be just as ripe and tasty as those that are solid orange in color. Avoid those that have soft spots or traces of mold. And, because oranges are among the top 20 foods in which pesticide residues are most frequently found, buy organic oranges whenever possible.

Choose oranges that have smoothly textured skin and are firm and heavy for their size. These will have a higher juice content than those that are either spongy or lighter in weight. In general, oranges that are smaller will be juicier than those that are larger in size, as will those that feature thinner skins.

Oranges can either be stored at room temperature or in the refrigerator, depending upon your preference. They will generally last the same amount of time, two weeks with either method, and will retain nearly the same level of their vitamin content. The best way to store oranges is loose rather than wrapped in a plastic bag since if exposed to moisture, they can easily develop mold.

Orange juice and zest can also be stored for later use. Place freshly squeezed orange juice in ice cube trays until frozen, and then store them in plastic bags in the freezer. Dried orange zest should be stored in a cool, dry place in an airtight glass container.

How to Enjoy

A Few Quick Serving Ideas

- Healthy sauté onions and ginger, and then deglaze the pan with orange juice. Use this liquid as a sauce for salmon or tuna.
- Orange segments, fennel and boiled beets make a delightfully refreshing salad.
- Gently simmer sweet potatoes, winter squash and orange segments in orange juice. Before serving, sprinkle with walnuts.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Oranges, fresh **1.00 medium** **131.00 grams**				**Calories: 62** **GI: low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin C	69.69 mg	93	27.2	excellent
fiber	3.14 g	13	3.7	very good
folate	39.30 mcg	10	2.9	good
vitamin B1	0.11 mg	9	2.7	good
potassium	237.11 mg	7	2.0	good
copper	0.06 mg	7	1.9	good
pantothenic acid	0.33 mg	7	1.9	good
calcium	52.40 mg	5	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Papaya

Deliciously sweet with musky undertones and a soft, butter-like consistency, it is no wonder the papaya was reputably called the "fruit of the angels" by Christopher Columbus. Once considered quite exotic, they can now be found in markets throughout the year. Although there is a slight seasonal peak in early summer and fall, papaya trees produce fruit year round.

Papayas are spherical or pear-shaped fruits that can be as long as 20 inches. The ones commonly found in the market usually average about 7 inches and weigh about one pound. Their flesh is a rich orange color with either yellow or pink hues. Inside the inner cavity of the fruit are black, round seeds encased in a gelatinous-like substance. Papaya's seeds are edible, although their peppery flavor is somewhat bitter. The fruit, as well as the other parts of the papaya tree, contain papain, an enzyme that helps digest proteins. This enzyme is especially concentrated in the fruit when it is unripe. Papain is extracted to make digestive enzyme dietary supplements and is also used as an ingredient in some chewing gums.

Papaya, fresh
1.00 medium
(276.00 grams)

Calories: 119
GI: medium

Nutrient	DRI/DV
vitamin C	224%
folate	26%
fiber	19%
vitamin A	15%
magnesium	14%
potassium	14%
copper	13%
pantothenic acid	11%

Health Benefits

Papayas offer not only the luscious taste and sunlit color of the tropics, but are rich sources of antioxidant nutrients such as carotenes, vitamin C and flavonoids; the B vitamins, folate and pantothenic acid; and the minerals, potassium, copper, and magnesium; and fiber. Together, these nutrients promote the health of the cardiovascular system and also provide protection against colon cancer. In addition, papaya contains the digestive enzyme, *papain*, which is used like bromelain, a similar enzyme found in pineapple, to treat sports injuries, other causes of trauma, and allergies.

Protection Against Heart Disease

Papayas may be very helpful for the prevention of atherosclerosis and diabetic heart disease. Papayas are an excellent source of the powerful antioxidants vitamin C and vitamin A (through their concentration of pro-vitamin A carotenoid phytonutrients).

These nutrients help prevent the oxidation of cholesterol. Only when cholesterol becomes oxidized is it able to stick to and build up in blood vessel walls, forming dangerous plaques that can eventually cause heart attacks or strokes. One way in which dietary vitamin E and vitamin C may exert this effect is through their suggested association with a compound called paraoxonase, an enzyme that inhibits LDL cholesterol and HDL cholesterol oxidation.

Papayas are also a good source of fiber, which has been shown to lower high cholesterol levels. The folic acid found in papayas is needed for the conversion of a substance called homocysteine into benign amino acids such as cysteine or methionine. If unconverted, homocysteine can directly damage blood vessel walls and, if levels get too high, is considered a significant risk factor for a heart attack or stroke.

Promotes Digestive Health

The nutrients in papaya have also been shown to be helpful in the prevention of colon cancer. Papaya's fiber is able to bind to cancer-causing toxins in the colon and keep them away from the healthy colon cells. In addition, papaya's folate, vitamin C, beta-carotene, and vitamin E have each been associated with a reduced risk of colon cancer.

These nutrients provide synergistic protection for colon cells from free radical damage to their DNA. Increasing your intake of these nutrients by enjoying papaya is an especially good idea for individuals at risk of colon cancer.

Anti-Inflammatory Effects

Papaya contains several unique protein-digesting enzymes including *papain* and *chymopapain*. These enzymes have been shown to help lower inflammation and to improve healing from burns. In addition, the antioxidant nutrients found in papaya, including vitamin C and beta-carotene, are also very good at reducing inflammation. This may explain why people with diseases that are worsened by inflammation, such as asthma, osteoarthritis, and rheumatoid arthritis, find that the severity of their condition is reduced when they get more of these nutrients.

Immune Support

Vitamin C and vitamin A, which is made in the body from the beta-carotene in papaya, are both needed for the proper function of a healthy immune system. Papaya may therefore be a healthy fruit choice for preventing such illnesses as recurrent ear infections, colds and flu.

Protection against Macular Degeneration

Your mother may have told you carrots would keep your eyes bright as a child, but as an adult, it looks like fruit is even more important for keeping your sight. Data reported in a study published in the *Archives of Ophthalmology* indicates that eating 3 or more servings of fruit per day may lower your risk of age-related macular degeneration (ARMD), the primary cause of vision loss in older adults, by 36%, compared to persons who consume less than 1.5 servings of fruit daily. In this study, which involved over 110,000 women and men, researchers evaluated the effect of study participants' consumption of fruits; vegetables; the antioxidant vitamins A, C, and E; and carotenoids on the development of early ARMD or neovascular ARMD, a more severe form of the illness associated with vision loss. While, surprisingly, intakes of vegetables, antioxidant vitamins and carotenoids were not strongly related to incidence of either form of ARMD, fruit intake was definitely protective against the severe form of this vision-destroying disease. Three servings of fruit may sound like a lot to eat each day, but papaya can help you reach this goal. Add slices of fresh papaya to your morning cereal, lunch time yogurt or green salads. Cut a papaya in half and fill with cottage cheese, crab, shrimp or tuna salad. For an elegant meal, place slices of fresh papaya over any broiled fish.

Protection against Rheumatoid Arthritis

While one study suggests that high doses of supplemental vitamin C makes osteoarthritis, a type of degenerative arthritis that occurs with aging, worse in laboratory animals, another indicates that vitamin C-rich foods, such as papaya, provide humans with protection against inflammatory polyarthritis, a form of rheumatoid arthritis involving two or more joints.

The findings, presented in the *Annals of the Rheumatic Diseases* were drawn from a study of more than 20,000 subjects and focused on subjects who developed inflammatory polyarthritis and similar subjects who remained arthritis-free during the follow-up period. Subjects who consumed the lowest amounts of vitamin C-rich foods were more than three times more likely to develop arthritis than those who consumed the highest amounts.

Papaya and Green Tea Team Up to Prevent Prostate Cancer

Choosing to regularly eat lycopene-rich fruits, such as papaya, *and* drink green tea may greatly reduce a man's risk of developing prostate cancer, suggests research published the *Asia Pacific Journal of Clinical Nutrition* (Jian L, Lee AH, et al.)

In this case-control study involving 130 prostate cancer patients and 274 hospital controls, men drinking the most green tea were found to have an 86% reduced risk of prostate cancer compared, to those drinking the least.

A similar inverse association was found between the men's consumption of lycopene-rich fruits and vegetables such as tomatoes, apricots, pink grapefruit, watermelon, papaya, and guava. Men who most frequently enjoyed these foods were 82% less likely to have prostate cancer compared to those consuming the least lycopene-rich foods.

Regular consumption of both green tea and foods rich in lycopene resulted in a synergistic protective effect, stronger than the protection afforded by either, the researchers also noted.

Practical Tips: Get in the habit of drinking green tea and eating lycopene-rich foods.

- Take a quart of iced green tea to work and sip throughout the day or take it to the gym to provide prostate protection while replenishing fluids after your workout.
- Pack a ziploc bag of apricots and almonds in your briefcase or gym bag for a handy snack.
- Start your breakfast with a half grapefruit or a glass of papaya or guava juice.
- Add papaya to any smoothie or fruit salad or use as a delectable garnish for fish.
- For a delicious summer lunch, cut a papaya in half, scoop out the seeds, sprinkle with lime juice and top with cottage cheese, a fresh mint leaf, and roasted almonds.
- Begin lunch or dinner with some spicy tomato juice on the rocks with a twist of lime. Snack on tomato crostini: in the oven, toast whole wheat bread till crusty, then top with tomato sauce, herbs, a little grated cheese, and reheat until the cheese melts.
- Top whole wheat pasta with olive oil, pine nuts, feta cheese and a rich tomato sauce for lunch or dinner.

Description

Papayas are fruits that remind us of the tropics, the regions of the world in which they are grown. Once considered an exotic fruit, papayas' rise in popularity has made them much more available.

Papayas are spherical or pear-shaped fruits that can be as long as 20 inches. The ones commonly found in the market usually average about 7 inches and weigh about one pound. Their flesh is a rich orange color with either yellow or pink hues.

Papaya has a wonderfully soft, butter-like consistency and a deliciously sweet, musky taste. Inside the inner cavity of the fruit are black, round seeds encased in a gelatinous-like substance. Papaya's seeds are edible, although their peppery flavor is somewhat bitter.

The fruit, as well as the other parts of the papaya tree, contain *papain*, an enzyme that helps digest proteins. This enzyme is especially concentrated in the fruit when it is unripe. Papain is extracted to make digestive enzyme dietary supplements and is also used as an ingredient in some chewing gums.

History

Papayas, native to Central America, have been long revered by the Latin American Indians. Spanish and Portuguese explorers brought papayas to many other subtropical lands to which they journeyed including India, the Philippines, and parts of Africa.

This revered tropical fruit was reputably called "the fruit of the angels" by Christopher Columbus. In the 20th century, papayas were brought to the United States and have been cultivated in Hawaii, the major U.S. producer since the 1920s. Today, the largest commercial producers of papayas include the United States, Mexico and Puerto Rico.

How to Select and Store

If you want to eat them within a day of purchase, choose papayas that have reddish-orange skin and are slightly soft to the touch. Those that have patches of yellow color will take a few more days to ripen.

Papayas that are totally green or overly hard should not be purchased, unless you are planning on cooking them, or unless you want to use green papayas in a cold dish like an Asian salad, as their flesh will not develop its characteristic sweet juicy flavor.

While a few black spots on the surface will not affect the papaya's taste, avoid those that are bruised or overly soft. Papayas are more available during the summer and fall; however, you can usually purchase them throughout the year.

Papayas that are partially yellow should be left at room temperature where they will ripen in a few days. If you want to speed this process, place them in a paper bag with a banana. Ripe papayas should be stored in the refrigerator and consumed within one or two days, so you can enjoy their maximum flavor.

How to Enjoy

A Few Quick Serving Ideas

- Mix diced papaya, cilantro, jalapeno peppers and ginger together to make a unique salsa that goes great with shrimp, scallops and halibut.

- Sprinkle papaya with fresh lime juice and enjoy as is.
- Slice a small papaya lengthwise and fill with fruit salad.
- In a blender, combine papaya, strawberries and yogurt for a cold soup treat.

Safety

Papayas and Latex-Fruit Syndrome

Latex-fruit syndrom is a health problem related to the possible reaction of our immune system to certain proteins found in natural rubber (from the tree *Hevea brasiliensis*) and highly similar proteins found in certain foods, such as papayas. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Papaya, fresh
1.00 medium
276.00 grams

Calories: 119
GI: medium

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin C	168.08 mg	224	34.0	excellent
folate	102.12 mcg	26	3.9	very good
fiber	4.69 g	19	2.8	good
vitamin A	131.10 mcg RAE	15	2.2	good
magnesium	57.96 mg	14	2.2	good
potassium	502.32 mg	14	2.2	good
copper	0.12 mg	13	2.0	good
pantothenic acid	0.53 mg	11	1.6	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Pears

What's New and Beneficial About Pears

- For nutritional reasons, we're often advised to consume the skins of fruits. However, it's less often that research provides strong evidence in support of this advice. Recent studies have shown that the skin of pears contains at least three to four times as many phenolic phytonutrients as the flesh. These phytonutrients include antioxidant, anti-inflammatory flavonoids, and potentially anti-cancer phytonutrients like cinnamic acids. The skin of the pear has also been show to contain about half of the pear's total dietary fiber.
- In recent studies measuring risk of type 2 diabetes in U.S. women, pears have earned very special recognition. Researchers now know that certain flavonoids in food can improve insulin sensitivity, and of special interest in this area have been three groups of flavonoids (flavonols, flavan-3-ols, and anthocyanins). All pears contain flavonoids falling within the first two groups, and red-skinned pears contain anthocyanins as well. Intake of these flavonoid groups has been associated with decreased risk of type 2 diabetes in both women and men. However, a new analysis of the Nurses' Health Study has shown that among *all* fruits and vegetables analyzed for their flavonoid content, the combination of apples/pears showed the most consistent ability to lower risk of type 2 diabetes. We believe that this special recognition given to pears as a fruit that can help lower risk of type 2 diabetes in women is likely to be followed by future studies showing this same benefit for men.
- You've no doubt heard someone say that cloudy fruit juices containing fruit pulp provide better nourishment than clear fruit juices that have had their pulp removed through filtering. Scientists have now proven that statement to be correct with respect to pear juice. With their pulp removed, pear juices were determined to lose up to 40% of their total phenolic phytonutrients, and to have significantly reduced antioxidant capacity. "Cloudy" pear juices (technically referred to as "high turbidity" juices) emerged as the superior juice type in terms of nutrient content as well as antioxidant benefits.

Pear, fresh
1.00 medium
(178.00 grams)

Calories: 101
GI: low

Nutrient	DRI/DV
fiber	22%
copper	17%
vitamin C	10%
vitamin K	9%

Health Benefits

Antioxidant and Anti-Inflammatory Support

While pears are not an unusual source of conventional antioxidant or anti-inflammatory nutrients (for example, vitamin E or omega-3 fatty acids), the phytonutrient category is where this fruit excels. For example, in the Baltimore Longitudinal Study of Aging (1,638 participants, average age range 62-69 years), the combination of apples/pears ranked as the second highest source of flavonols among all fruits and vegetables - partly due to the epicatechin richness of pears. Average flavonol intake in the study was about 14 milligrams per day, and one pear can provide about half of this amount all by itself. The list of phytonutrients found in pears has been of special interest to researchers, and the list below summarizes their findings about key phytonutrients provided by this fruit.

Hydroxybenzoic acids

- chlorogenic acid
- gentisic acid
- syringic acid
- vanillic acid

Hydroxycinnamic acids

- coumaric acid

- ferulic acid
- 5-caffeoylquinic acid

Hydroxyquinones

- arbutin

Flavanols, also known as Flavan-3-ols

- catechin
- epicatechin

Flavonols

- isorhamnetin
- quercetin
- kaempferol

Anthocyanins (in red-skinned varieties, including Red Anjou, Red Bartlett, Comice, Seckel, and Starkrimson)

Carotenoids

- beta-carotene
- lutein
- zeaxanthin

Virtually all of these phytonutrients have been shown to provide us with antioxidant as well as anti-inflammatory benefits. As a result, intake of pears has now been associated with decreased risk of several common chronic diseases that begin with chronic inflammation and excessive oxidative stress. These diseases include heart disease and type 2 diabetes.

Decreased Risk of Type 2 Diabetes and Heart Disease

As a very good source of dietary fiber, pears might logically be expected to help protect us from development of type 2 diabetes (or DM2, which stands for "diabetes mellitus type 2) as well heart disease. Adequate intake of dietary fiber is a long-established factor in reducing our risk of both diseases, and in the case of pears, this benefit may be even more pronounced due to the helpful combination of both soluble and insoluble fiber in this fruit. In addition to their fiber content, however, pears have other ways of helping to protect us against these diseases. In the case of DM2, scientists now know that pear flavonols (including isorhamnetin, quercetin, and kaempferol), flavan-3-ols (especially epicatechin), and the anthocyanins (found in red-skinned varieties including Red Anjou, Red Bartlett, Comice, Seckel, and Starkrimson) all help improve insulin sensitivity. (More and more research attention is being given to mechanisms of action in this area, including regulation of the enzyme NADPH oxidase.) In the case of heart disease, recent research has shown that pear fibers are able to bind together with bile acids in the intestine, lowering the pool of bile acids and decreasing the synthesis of cholesterol. In addition, the phytonutrients in pear may play a special role in these fiber-bile acid interactions. The ability of pear fibers (and other fruit fibers) to bind bile acids has actually been compared to the cholesterol-lowering drug cholestyramine, with pears showing about 5% of the ability of the drug to accomplish this result. (Among commonly eaten fruits, only bananas and pineapples showed more bile acid-binding ability at 9% and 6%, respectively.)

Reduced Cancer Risk

The health benefits of pear fiber also extend into the area of cancer risk. Fiber from pear can bind together not only with bile acids as a whole, but also with a special group of bile acids called secondary bile acids. Excessive amounts of secondary bile acids in the intestine can increase our risk of colorectal cancer (as well as other intestinal problems). By binding together with secondary bile acids, pear fibers can help decrease their concentration in the intestine and lower our risk of cancer development. In the case of stomach cancer (gastric cancer), intake of pears has also been shown to lower cancer risk. Here the key focus has not been on pear fiber, however, but on pear phytonutrients, especially cinnamic acids (including coumaric acid, ferulic acid, and 5-caffeoylquinic acid). In a recent study from Mexico City, it took approximately 2 total fruit servings per day and 4 daily vegetable servings to accomplish a decrease in gastric cancer risk. Pears and mangos were among the key foods determined to provide cinnamic acids in the study.

Esophageal cancer (specifically, esophageal squamous cell carcinoma, or ESCC) is a third cancer type for which pear intake helps lower risk. In a very large-scale study conducted by the National Institutes of Health and the American Association of Retired Persons (involving 490,802 participants), pears were found to be a key food associated with reduced risk of ESCC. Interestingly, numerous foods belonging the rose (*Rosaceae*) family were also found to lower risk of ESCC, including apples, plums, and strawberries.

Other Health Benefits

It's become fairly common to hear both laypersons and healthcare practitioners talking about pear as one of the more easily digested fruits. In fact, many practitioners recommend that pear be one of the first fruits considered when it comes time to introducing an infant to his or her first pureed fruits. Even though we have been unable to find large-scale human studies to support these digestibility claims, we don't question the fact that easier digestion has been experienced by many individuals in the context of pears versus other fruits. One factor that may come into play here is the low acid nature of pears, especially in comparison to widely enjoyed citrus fruits like lemons, grapefruits, and oranges.

It's also become fairly common to hear pears being described as a "hypoallergenic" (low allergy) food. Healthcare practitioners often allow clients to continue eating pears when following a low-allergy diet plan, and many individuals report having fewer allergy-related symptoms when consuming pears versus other fruits. Of course, no fruits are classified as major allergens according to the U.S. Centers for Disease Control and their rules for identification of allergenic foods on product labels. In addition, we have been unable to find large-scale research studies to support any low-allergy claims for pears. Still, we do not question the fact that many people seem to do much better when consuming pears versus other fruits in terms of allergic response.

It's very possible that these two experiences - better digestibility and decreased allergic response - are related, and that future research will help us understand why pears may provide us with special health benefits in these areas.

Description

Pears are a member of the rose family of plants (*Rosaceae*), which, in addition (of course) to roses, contains a long list of fruits including apples, apricots, cherries, chokeberry, crabapples, loquats, peaches, plums, quinces, raspberries, serviceberries, and strawberries as well as the tree nut, almonds. The many different varieties of pears commonly found in U.S. groceries all belong to the same category known as European Pear (*Pyrus communis*). These pears typically have a rounded body that tapers into a neck of various lengths.

They are distinct from (but closely related to) the fruit we commonly call "pear apple." Pear apples are completely round with no necks, and while they remind of us of apples in shape, their skins make us think they are pears. Contrary to popular belief, pear apples are not a cross between apples and pears. Pear apples belong to a second category of pear, broadly referred to as Asian pear. Included in this second category are Chinese pear, Japanese pear, and Korean pear (*Pyrus pyrifolia*) as well as Siberian/Manchurian pear (*Pyrus ussuriensis*). When these categories are combined, they account for more than 3,000 varieties of pears that people enjoy worldwide.

Pears are found in a variety of colors, including many different shades of green, red, yellow/gold, and brown. Many varieties fail to change color as they ripen, making it more difficult to determine ripeness. (For more about selection of pears, please see our How to Select and Store section.)

The list below describes some of the more commonly enjoyed varieties of pears:

- *Bartlett:* best known of the pear varieties in the U.S., and most often the variety found in cans. Bartletts are yellow/green and speckled, and sometimes called *Williams* pears
- *Bosc:* cinnamon brown-skinned pears with long tapered necks with a honey-like but complex flavor
- *Comice:* round, short pears with either green and red coloring, or sometimes almost completely red with especially soft and juicy flesh
- *Concorde:* tall, skinny, and golden/green pears with flesh that is firmer and more dense than many other varieties
- *Forelle:* red/green and speckled like a trout, and thus the name, meaning "trout" in German. A small-sized pear that yellows as it ripens.
- *Green Anjou:* a widely available, compact, and short-necked pear. It doesn't change color much while ripening, so you'll need to use the stem test described in our How to Select and Store section.

- *Red Anjou:* very much like its green counterpart, except a rich reddish maroon in color and higher in anthocyanins (which is the main reason for its rich red color)
- *Red Bartlett:* very much like its yellow/green counterpart, except with an all-round bright red skin, they sometimes feature light vertical striping, and like Red Anjou, they are rich in anthocyanins
- *Seckel:* smallest of the commonly eaten pears, usually yellow/green or olive green in color, and mixed with broad patches of red
- *Starkrimson:* bright crimson red color, more narrow-necked that Red Anjou, but equally rich in anthocyanins and especially gorgeous in a salad

History

There is some debate about the exact origins of the European pear, but many experts believe that European pears (*Pyrus communis*) and Asian pears (both *Pyrus pyrifolia* and *Pyrus ussuriensis*) evolved separately and during the same approximate time in history (roughly 1000 BC). Certain species of pear are also native to parts of Africa.

Beginning in the 1500's, Eurpoean colonists began to bring pears to North America, where they apparently were not native or enjoyed before that time. While pears were cultivated there during those years, the colonists continued to import most of the pears they consumed from Europe, and especially from France. Today, pears grown in Europe have become a very small part of the U.S. diet. While the U.S. continues to import over 75,000 metric tons of pears each year, the vast majority now come from Argentina, Chile, China, South Korea and New Zealand.

On a worldwide basis, China has become the world's largest grower of pears. Out of 21 million tons produced worldwide, China now produces about 15.5 million tons, or nearly three-quarters of the world total. Of the remaining 5.5 million tons, another 2.7 come from Europe, 1.1 from Argentina and Chile, 0.8 from the U.S., and smaller amounts from New Zealand, South Korea, and other countries.

Within the U.S., the state of Washington is by far the largest grower of pears, accounting for about half of all U.S.-produced pears. California and Oregon follow next, with significant commercial production also occurring in New York and Pennsylvania.

How to Select and Store

Since pears are very perishable once they are ripe, the pears you find at the market will generally be unripe and will require a few days of maturing. Look for pears that are firm, but not too hard. They should have a smooth skin that is free of bruises or mold. The color of good quality pears may not be uniform as some may feature russetting where there are brown-speckled patches on the skin; this is an acceptable characteristic and oftentimes reflects a more intense flavor. Avoid pears that are punctured or have dark soft spots.

It is possible, of course, that you may find ripe pears at the market. When trying to determine whether a pear is ripe, don't start by squeezing the whole fruit. Instead, we recommend gently pressing only at the top of the pear, near its stem. If that spot gives in to pressure, the pear is probably optimally ripe for eating. If the flesh feels extremely soft, almost to the point of being squishy, the pear is overripe. For food safety reasons, we recommend that overripe pears only be used in cooked recipes rather than eaten raw.

As with all of the World's Healthiest Foods, we recommend that you purchase certified organic pears to lower your risk of exposure to unwanted pesticides, sewage sludge contaminants, and any potential risks associated with irradiation or genetic engineering. Fortunately, over 250 certified organic farms in the U.S. now produce over 20,000 tons of organic pears, and so these delicious fruits are getting easier to find in organic form.

If you will not be consuming the pears immediately once they have ripened, you can place them in the refrigerator where they will remain fresh for a few days. If you want to hasten the ripening process, place them in a paper bag, turning them occasionally, and keep them at room temperature. Storing pears in sealed plastic bags or restricted spaces where they are in too close proximity to each other should be avoided since they will have limited exposure to oxygen, and the ethylene gas that they naturally produce will greatly increase their ripening process, causing them to degrade. Pears should also be stored away from other strong smelling foods, whether on the countertop on in the refrigerator, as they tend to absorb smells.

How to Enjoy

A Few Quick Serving Ideas

- Combine pears with mustard greens, watercress, leeks and walnuts for a delicious salad.
- Serve pears with goat or bleu cheese for a delightful dessert.
- Add chopped pears, grated ginger and honey to millet porridge for a pungently sweet breakfast treat.
- Core pears, and poach in apple juice or wine.

WHFoods Recipes That Feature Pears

- Holiday Cranberry Relish
- Cranberry and Fresh Pear Cobbler

Safety

Between 2008-2011, concerns arose in both the U.S. and Canada over contamination with arsenic of certain brand-name pear juices. While we have never seen official reports pinpointing the exact source of the contamination, it would not be uncommon for a food like pear juice - made from pears that may have been imported from nearly a dozen countries throughout the world - to pick up unwanted heavy metal residues (like arsenic) from groundwater contamination, soil contamination, sewage sludge fertilization, or some combination of these sources. Pear juices found to be contaminated were recalled by the U.S. Food and Drug Association (FDA) and the Canadian Food Inspection Agency (CFIA), and the FDA also set a Level of Concern for arsenic in fruit juices (including pear juice) of 23 parts per million (for long-term, routine consumption of pear juice). Companies who voluntarily chose to monitor their pear juice production were then able to use this standard as a guideline. These events are one of the reasons we encourage selection of organic pear juice (and fresh pears). Organic food regulations greatly lessen the chance of exposure to heavy metals like arsenic not only in pear juice and pears but in all other foods as well.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Pear, fresh **1.00 medium** **178.00 grams**				**Calories: 101** **GI: low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
fiber	5.52 g	22	3.9	very good
copper	0.15 mg	17	3.0	good
vitamin C	7.65 mg	10	1.8	good
vitamin K	7.83 mcg	9	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Pineapple

Pineapples have exceptional juiciness and a vibrant tropical flavor that balances the tastes of sweet and tart. They are second only to bananas as America's favorite tropical fruit. Although the season for pineapple runs from March through June, they are available year-round in local markets.

Pineapples are a composite of many flowers whose individual fruitlets fuse together around a central core. Each fruitlet can be identified by an "eye," the rough spiny marking on the pineapple's surface. Pineapples have a wide cylindrical shape, a scaly green, brown or yellow skin and a regal crown of spiny, blue-green leaves and fibrous yellow flesh. The area closer to the base of the fruit has more sugar content and therefore a sweeter taste and more tender texture.

Pineapple, chunks, fresh
1.00 cup
(165.00 grams)

Calories: 83
GI: medium

Nutrient	DRI/DV
vitamin C	105%
manganese	77%
copper	20%
vitamin B6	11%
vitamin B1	11%
fiber	9%
folate	7%
pantothenic acid	7%

Health Benefits

Potential Anti-Inflammatory and Digestive Benefits

Bromelain is a complex mixture of substances that can be extracted from the stem and core fruit of the pineapple. Among dozens of components known to exist in this crude extract, the best studied components are a group of protein-digesting enzymes (called cysteine proteinases). Originally, researchers believed that these enzymes provided the key health benefits found in bromelain, a popular dietary supplement containing these pineapple extracts. In addition, researchers believed that these benefits were primarily limited to help with digestion in the intestinal tract. However, further studies have shown that bromelain has a wide variety of health benefits, and that many of these benefits may not be related to the different enzymes found in this extract. Excessive inflammation, excessive coagulation of the blood, and certain types of tumor growth may all be reduced by therapeutic doses of bromelain when taken as a dietary supplement. Studies are not available, however, to show these same potential benefits in relationship to normal intake of pineapple within a normal meal plan.

Bromelain extracts can be obtained from both the fruit core and stems of pineapple. Potentially important chemical differences appear to exist between extracts obtained from the stem versus the core fruit. However, the practical relevance of these differences is not presently understood. Most of the laboratory research on bromelain has been conducted using stem-based extracts, however.

Although healthcare practitioners have reported improved digestion in their patients with an increase in pineapple as their "fruit of choice" within a meal plan, we haven't seen published studies that document specific changes in digestion following consumption of the fruit (versus supplementation with the purified extract. However, we suspect that the core fruit will eventually turn out to show some unique health-supportive properties, including possible digestion-related and anti-inflammatory benefits.

Antioxidant Protection and Immune Support

Vitamin C is the body's primary water-soluble antioxidant, defending all aqueous areas of the body against free radicals that attack and damage normal cells. Free radicals have been shown to promote the artery plaque build-up of atherosclerosis and diabetic heart disease, cause the airway spasm that leads to asthma attacks, damage the cells of the colon so they become colon cancer cells, and contribute to the joint pain and disability seen in osteoarthritis and rheumatoid arthritis. This would explain why diets rich in vitamin C have been shown to be useful for preventing or reducing the severity of all of these conditions. In addition, vitamin C is vital for the proper function of the immune system, making it a nutrient to turn to for the prevention of recurrent ear infections, colds, and flu.

Manganese and Thiamin (Vitamin B1) for Energy Production and Antioxidant Defenses

Pineapple is an excellent source the trace mineral manganese, which is an essential cofactor in a number of enzymes important in energy production and antioxidant defenses. For example, the key oxidative enzyme superoxide dismutase, which disarms free radicals produced within the mitochondria (the energy production factories within our cells), requires manganese. In addition to manganese, pineapple is a good source of thiamin, a B vitamin that acts as a cofactor in enzymatic reactions central to energy production.

Protection against Macular Degeneration

Your mother may have told you carrots would keep your eyes bright as a child, but as an adult, it looks like fruit is even more important for keeping your sight. Data reported in a study published in the *Archives of Ophthalmology* indicates that eating 3 or more servings of fruit per day may lower your risk of age-related macular degeneration (ARMD), the primary cause of vision loss in older adults, by 36%, compared to persons who consume less than 1.5 servings of fruit daily.

In this study, which involved over 110,000 women and men, researchers evaluated the effect of study participants' consumption of fruits; vegetables; the antioxidant vitamins A, C, and E; and carotenoids on the development of early ARMD or neovascular ARMD, a more severe form of the illness associated with vision loss. While, surprisingly, intakes of vegetables, antioxidant vitamins and carotenoids were not strongly related to incidence of either form of ARMD, fruit intake was definitely protective against the severe form of this vision-destroying disease. Three servings of fruit may sound like a lot to eat each day, but pineapple can help you reach this goal. Add fresh pineapple to your morning smoothie, lunch time yogurt, any fruit and most vegetable salads. For example, try adding chunks of pineapple to your next coleslaw or carrot salad.

Description

Pineapple, *Ananas comosus*, belongs to the *Bromeliaceae* family, from which one of its most important health-promoting compounds, the enzyme bromelain, was named. The Spanish name for pineapple, *pina*, and the root of its English name, reflects the fruit's visual similarity to the pinecone.

Pineapples are actually not just one fruit but a composite of many flowers whose individual fruitlets fuse together around a central core. Each fruitlet can be identified by an "eye," the rough spiny marking on the pineapple's surface.

Pineapples have a wide cylindrical shape, a scaly green, brown or yellow skin and a regal crown of spiny, blue-green leaves. The fibrous flesh of pineapple is yellow in color and has a vibrant tropical flavor that balances the tastes of sweet and tart. The area closer to the base of the fruit has more sugar content and therefore a sweeter taste and more tender texture.

History

Although thought to have originated in South America, pineapples were first discovered by Europeans in 1493 on the Caribbean island that came to be known as Guadalupe. When Columbus and other discovers brought pineapples back to Europe, attempts were made to cultivate the sweet, prized fruit until it was realized that the fruit's need for a tropical climate inhibited its ability to flourish in this region. By the end of the 16th century, Portuguese and Spanish explorers introduced pineapples into many of their Asian, African and South Pacific colonies, countries in which the pineapple is still being grown today.

Since pineapples are very perishable, and modes of transportation to bring them stateside from the Caribbean Islands were relatively slow centuries ago, fresh pineapples were a rarity that became coveted by the early American colonists. While glazed, sugar-coated pineapples were a luxurious treat, it was the fresh pineapple itself that became the sought after true symbol of prestige and social class. In fact, the pineapple, because of its rarity and expense, was such a status item in those times that all a party hostess had to do was to display the fruit as part of a decorative centerpiece, and she would be awarded more than just a modicum of social awe and recognition.

In the 18th century, pineapples began to be cultivated in Hawaii, the only state in the U.S. in which they are still grown. In addition to Hawaii, other countries that commercially grow pineapples include Thailand, the Philippines, China, Brazil and Mexico.

How to Select and Store

Look for pineapples that are heavy for their size. While larger pineapples will have a greater proportion of edible flesh, there is usually no difference in quality between a small and large size pineapple. Pineapples should be free of soft spots, bruises and darkened "eyes," all of which may indicate that the pineapple is past its prime. Pineapple stops ripening as soon as it is picked, so choose fruit with a fragrant sweet smell at the stem end. Avoid pineapple that smells musty, sour or fermented.

Pineapple can be left at room temperature for one or two days before serving. While this process will not make the fruit any sweeter, it will help it to become softer and more juicy. Yet, as they are very perishable, you should still watch them closely during this period to ensure that they do not spoil. After two days, if you are still not ready to consume the pineapple, you should wrap it in a plastic bag and store it in the refrigerator where it will keep for a maximum of three to five days.

Pineapple that has been cut up should be stored in the refrigerator in an airtight container. It will stay fresher and retain more taste and juiciness if you also place some liquid, preferably some juice from the pineapple, in the container. Although pineapple can be frozen, this process greatly affects its flavor.

How to Enjoy

A Few Quick Serving Ideas

- Combine diced pineapple with chopped shrimp, grated ginger and a little olive oil. Season to taste and serve this fragrant shrimp salad on a bed of romaine lettuce.
- Mix diced pineapple and chili peppers for an easy to prepare salsa that's an exceptional complement to fish such as halibut, tuna and salmon.
- Drizzle maple syrup on pineapple slices and broil until brown. Serve plain or with yogurt.
- Chopped pineapple, grated fennel and cashews go well together and are especially delicious as a side dish to chicken.
- Pineapple is a wonderful addition to fruit salads, especially those containing other tropical fruits such as papaya, kiwi and mango.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Pineapple, chunks, fresh **1.00 cup** **165.00 grams**				**Calories: 83** **GI: medium**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin C	78.87 mg	105	22.9	excellent
manganese	1.53 mg	77	16.7	excellent
copper	0.18 mg	20	4.4	very good
vitamin B1	0.13 mg	11	2.4	good
vitamin B6	0.18 mg	11	2.3	good
fiber	2.31 g	9	2.0	good
folate	29.70 mcg	7	1.6	good

pantothenic acid	0.35 mg	7	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Plums & Prunes

There are few fruits that come in such a panorama of colors as the juicy sweet tasting plum. The plum season extends from May through October with the Japanese varieties first on the market from May and peaking in August followed by the European varieties in the fall.

Plums belong to the *Prunus* genus of plants and are relatives of the peach, nectarine and almond. They are all considered "drupes," fruits that have a hard stone pit surrounding their seeds.

Prunes are the dried version of European plums. In the United States, through, you may not see the term "prunes" used as frequently as before, as this fruit items recently had its name officially changed to "dried plum." Sweet with a deep taste and a sticky chewy texture, prunes are not only fun to eat but they are also highly nutritious. As with other dried fruits, they are available year round.

Plum, fresh
1.00 2-1/8 inches
(66.00 grams)

Calories: 30
GI: low

Nutrient	DRI/DV
vitamin C	8%
vitamin K	5%
copper	4%
fiber	4%
potassium	3%

Health Benefits

Significant Antioxidant Protection from Phenols

The fresh version (plums) and the dried version (prunes) of the plant scientifically known as *Prunus domestica* have been the subject of repeated health research for their high content of unique phytonutrients called neochlorogenic and chlorogenic acid. These substances found in plum and prune are classified as phenols, and their function as antioxidants has been well-documented. These damage-preventing substances are particularly effective in neutralizing a particularly dangerous oxygen radical called superoxide anion radical, and they have also been shown to help prevent oxygen-based damage to fats. Since our cell membranes, brain cells and molecules such as cholesterol are largely composed of fats, preventing free radical damage to fats is no small benefit.

Better Iron Absorption Plus More Antioxidant Protection from Vitamin C

The ability of plums and prunes to increase absorption of iron into the body has also been documented in published research. This ability of plums and prunes to make iron more available may be related to the vitamin Ccontent of this fruit. Our food ranking system qualified plums as a very good source of vitamin C.

In addition to assisting with absorption of iron, vitamin C is needed in the body to make healthy tissue and is also needed for a strong immune system. Getting a little extra vitamin C around cold and flu season is a good idea, and may also be helpful for people who suffer from recurrent ear infections. Vitamin C also helps to protect cholesterol from becoming oxidized by free radicals. Since oxidized cholesterol is the kind that builds up in the arteries and causes damage to blood vessels, some extra vitamin C can be helpful for people who suffer from atherosclerosis or diabetic heart disease. In addition, vitamin C can help neutralize free radicals that could otherwise contribute to the development or progression of conditions like asthma, colon cancer, osteoarthritis, and rheumatoid arthritis, so vitamin C may be able to help those who are at risk or suffering from these conditions. Owing to the multitude of vitamin C's health benefits, it is not surprising that research has shown that consumption of vegetables and fruits high in this nutrient is associated with a reduced risk of death from all causes including heart disease, stroke and cancer.

Normalizing Blood Sugar Levels and Helping with Weight Loss

Prunes' soluble fiber helps normalize blood sugar levels by slowing the rate at which food leaves the stomach and by delaying the absorption of glucose (the form in which sugar is transported in the blood) following a meal. Soluble fiber also increases insulin sensitivity and can therefore play a helpful role in the prevention and treatment of type 2 diabetes. And, prunes' soluble fiber promotes a sense of satisfied fullness after a meal by slowing the rate at which food leaves the stomach, so prunes can also help prevent overeating and weight gain.

Prunes' Fiber for Regularity, Lower Cholesterol, & Intestinal Protection

Prunes are well known for their ability to prevent constipation. In addition to providing bulk and decreasing the transit time of fecal matter, thus decreasing the risk of colon cancer and hemorrhoids, prunes' insoluble fiber also provides food for the "friendly" bacteria in the large intestine. When these helpful bacteria ferment prunes' insoluble fiber, they produce a short-chain fatty acid called butyric acid, which serves as the primary fuel for the cells of the large intestine and helps maintain a healthy colon. These helpful bacteria also create two other short-chain fatty acids, propionic and acetic acid, which are used as fuel by the cells of the liver and muscles.

The propionic acid produced from prunes' insoluble fiber may also be partly responsible for the cholesterol-lowering properties of fiber. In animal studies, propionic acid has been shown to inhibit HMG-CoA reductase, an enzyme involved in the production of cholesterol by the liver. By lowering the activity of this enzyme, propionic acid helps lower blood cholesterol levels.

In addition, prunes' soluble fibers help to lower cholesterol by binding to bile acids and removing them from the body via the feces. Bile acids are compounds used to digest fat that are manufactured by the liver from cholesterol. When they are excreted along with prunes' fiber, the liver must manufacture new bile acids and uses up more cholesterol, thus lowering the amount of cholesterol in circulation. Soluble fiber may also reduce the amount of cholesterol manufactured by the liver.

Lastly, the insoluble fiber provided by prunes feed friendly bacteria in the digestive tract, which helps to maintain larger populations of friendly bacteria. In addition to producing the helpful short-chain fatty acids described above, friendly bacteria play an important protective role by crowding out pathogenic (disease-causing) bacteria and preventing them from surviving in the intestinal tract.

Description

One of the unique things about plums is that there are so many varieties available. Not only do over 2,000 varieties of plums exist, but over 100 are available in the United States alone. So, if you are looking for a juicy, sweet tasting fruit that comes in a panorama of colors, plums are for you.

Plums are classified into six general categories—Japanese, American, Damson, Ornamental, Wild and European/Garden—whose size, shape and colors vary. Although usually round, plums can also be oval or heart-shaped. The skins of plums can be red, purple, blue-black, red, green, yellow or amber, while their flesh comes in hues such as yellow, green and pink and orange—a virtual rainbow.

Plums belong to the *Prunus* genus of plants and are relatives of the peach, nectarine and almond. They are all considered "drupes," fruits that have a hard stone pit surrounding their seeds. When plums are dried, they become the fruit we know as prunes.

Prunes are nutritious fruits that are extremely fun to eat since they have a sweet, deep taste and a sticky, chewy texture. Prunes are actually dried plums, more specifically the dried version of European plums, including the Agen variety.

Unfortunately for the delicious and quite beneficial prune, its name has acquired a somewhat negative connotation, being associated with wrinkles, old age and sluggish gastrointestinal tracts. As our Health Benefits section shows, nothing could be further from the truth. To give prunes some PR that may help overcome this stigma and to promote prunes to their rightful place in the American diet, they have been informally christened with another name, a name that reflects their heritage . . . the "dried plum."

History

With the large number of plums available, it is not surprising that the various types have different heritages and places of origin. The European plum is thought to have been discovered around two thousand years ago, originating in the area near the

Caspian Sea. Even in ancient Roman times, there were already over 300 varieties of European plums. European plums made their way across the Atlantic Ocean with the pilgrims, who introduced them into the United States in the 17th century.

While Japanese plums actually originated in China, they derived their name from the country where much of their cultivation and development occurred. Japanese plums were introduced to the U.S. in the late 19th century. Today, the United States, Russia, China and Romania are among the main producers of commercially grown plums.

The process of drying plums to make prunes is thought to have originated thousands of years ago in an area near the Caspian Sea, the same region where the prune-producing European plums originated. They spread throughout Europe with the migration of different cultures and civilizations.

The process of drying plums to produce prunes took hold in California, now the leading producer of prunes worldwide, in the mid-19th century when Louis Pellier planted grafted plum tree cuttings brought back with him from his native France. Among these trees were those belonging to the Agen variety, the type of plum that is extremely well suited to be dried to make prunes.

How to Select and Store

Plums

If you want to purchase plums that are ripe and ready to eat, look for ones that yield to gentle pressure and that are slightly soft at their tip. While you can also purchase plums that are firm and ripen them at home, avoid those that are excessively hard as they will be immature and will probably not develop a good taste and texture profile. Good quality plums will feature a rich color and may still have a slight whitish bloom, reflecting that they have not been overhandled. They should also be free of punctures, bruises or any signs of decay. Plums are generally available in the marketplace from May through the early fall.

Plums that are not yet ripe can be left at room temperature. As this fruit tends to mature quickly, check on them in the next day or two to ensure that they do not become overripe. Once they are ripe, plums can be stored in the refrigerator for a few days. While plums can be frozen, to ensure maximum taste remove their stone pits before placing them in the freezer.

Prunes

Prunes are sold either with their pits or already pitted. The form you choose should depend upon your personal preference and recipe needs.

Ideally, you should purchase prunes that are sold in transparent containers so that you can evaluate them for quality. They should be plump, shiny, relatively soft and free of mold. If the packages are opaque, ensure that they are tightly sealed so that the prunes will not have lost any moisture. As with any other dried fruit, try to purchase prunes that are not processed with food preservatives such as sulfites.

Prunes should be stored in an airtight container in a cool, dry and dark place where they will keep for several months. Storing them in the refrigerator will extend their freshness, allowing them to keep for about six months. Regardless of where you store them, make sure that when you open the container, you reseal it tightly to prevent the prunes from losing moisture.

How to Enjoy

PLUMS

A Few Quick Serving Ideas

- Make pizza with a twist by broiling sliced plums, goat cheese, walnuts and sage on top of a whole wheat pita bread or pizza crust.
- For a delightful dessert, poach plums in a red wine and serve with lemon zest.
- Bake pitted plum halves in a 200°F(93°C) oven until they are wrinkled. Then mix them into a rye bread recipe for a scrumptiously sweet and hardy bread.
- Blend stewed plums and combine with yogurt and honey for wonderful cold soup.
- Add plum slices to cold cereal.

WHFoods Recipes That Feature Plums

- 5-Minute Fresh Plums in Sweet Sauce

PRUNES

A Few Quick Serving Ideas

- Serve stewed prunes with rosemary-scented braised lamb and enjoy this Middle Eastern inspired meal.
- Serve stewed or soaked prunes on top of pancakes and waffles.
- Combine diced dried prunes with other dried fruits and nuts to make homemade trail mix.
- Prunes make a delicious addition to poultry stuffing.

WHFoods Recipes That Feature Prunes

- Hot Polenta Breakfast with Dried Fruit Compote
- Millet with Dried Fruit Compote
- Prunes in Orange Sauce
- 15-Minute Dark Chocolate Truffles

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Plum, fresh
1.00 2-1/8 inches
66.00 grams

Calories: 30
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin C	6.27 mg	8	5.0	very good
vitamin K	4.22 mcg	5	2.8	good
copper	0.04 mg	4	2.6	good
fiber	0.92 g	4	2.2	good
potassium	103.62 mg	3	1.8	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Raspberries

What's New and Beneficial About Raspberries

- One of the most fascinating new areas of raspberry research involves the potential for raspberries to improve management of obesity. Although this research is in its early stages, scientists now know that metabolism in our fat cells can be increased by phytonutrients found in raspberries, especially rheosmin (also called raspberry ketone). By increasing enzyme activity, oxygen consumption, and heat production in certain types of fat cells, raspberry phytonutrients like rheosmin may be able to decrease risk of obesity as well as risk of fatty liver. In addition to these benefits, rheosmin can decrease activity of a fat-digesting enzyme released by our pancreas called pancreatic lipase. This decrease in enzyme activity may result in less digestion and absorption of fat.
- Recent research on organic raspberries has now shown organic raspberries to be significantly higher in total antioxidant capacity than non-organic raspberries. Raspberries in the study were grown on farms in Maryland that had been previously certified as organic by the U.S. Department of Agriculture. A series of tests involving free radical scavenging all provided the same results: organic raspberries outperformed their non-organic counterparts in terms of their antioxidant activity. This greater antioxidant capacity was associated with the greater levels of total phenols and total anthocyanins found in organic versus non-organic raspberries. While there are many good reasons to purchase organic versus non-organic foods of all kinds, this study makes it clear that these reasons specifically hold true for raspberries in a profound way.
- You'll get significantly more antioxidant support by purchasing raspberries that are fully ripe. Recent studies have measured the total phenolic content, total flavonoid content, and anthocyanin content of raspberries harvested at varying stages of ripeness (from 50% to 100% maturity) and greatest overall antioxidant benefits were associated with full ripeness of the berries. Although it's possible for raspberries to ripen after harvest, this fruit can be highly perishable and can mold quite easily at room temperature. So your most risk-free approach for getting optimal antioxidant benefits from raspberries is to purchase them at full maturity, keep them refrigerated at all times at temperatures between 35-39°F (2°-4°C), and consume them very quickly (within 1 to 2 days after purchase).
- Anti-cancer benefits of raspberries have long been attributed to their antioxidant and anti-inflammatory phytonutrients. In animal studies involving breast, cervical, colon, esophageal, and prostate cancers, raspberry phytonutrients have been shown to play an important role in lowering oxidative stress, reducing inflammation, and thereby altering the development or reproduction of cancer cells. But new research in this area has shown that the anti-cancer benefits of raspberries may extend beyond their basic antioxidant and anti-inflammatory aspects. Phytonutrients in raspberries may also be able to change the signals that are sent to potential or existing cancer cells. In the case of existing cancer cells, phytonutrients like ellagitannins in raspberries may be able to decrease cancer cell numbers by sending signals that encourage the cancer cells to being a cycle of programmed cell death (apoptosis). In the case of potentially but not yet cancerous cells, phytonutrients in raspberries may be able to trigger signals that encourage the non-cancerous cells to remain non-cancerous.

Raspberries, fresh
1.00 cup
(123.00 grams)

Calories: 64
GI: low

Nutrient	DRI/DV
vitamin C	43%
manganese	41%
fiber	32%
copper	12%
vitamin K	11%
pantothenic acid	8%
biotin	8%
vitamin E	7%
magnesium	7%
omega-3 fats	6%
folate	6%
potassium	5%

Health Benefits

Antioxidant and Anti-Inflammatory Benefits

The diversity of antioxidant and anti-inflammatory phytonutrients in raspberries is truly remarkable, and few commonly eaten fruits are able to provide us with greater diversity. From a research perspective, here is a partial list of phytonutrients in raspberries that provide us antioxidant and anti-inflammatory benefits:

- anthocyanins
  - cyanidins
  - pelargonidins
  - delphinidins
  - malvidins
- flavonols
  - quercetin
  - kaempferol
- flavanols
  - catechins
  - epicatechins
- flavonoid glycosides
  - tiliroside
- tannins
  - ellagitannins
  - gallotannins
  - proanthocyanidins
- hydroxybenzoic acids
  - ellagic acid
  - lambertianin
  - sanguiin
  - vanillic acid
  - gallic acid
  - chlorogenic acid
- hydroxycinnamic acids
  - caffeic acid
  - coumaric acid
  - ferulic acid
- stilbenoids
  - resveratrol

The vast majority of these phytonutrients are not only provided by raspberries, but provided in amounts that are significant in terms of protecting us against the dangers of oxidative stress and the dangers of excessive inflammation. By helping to scavenge free radical molecules, and by helping to regulate the activity of enzymes that could trigger unwanted inflammation, the phytonutrients in raspberries help lower our risk of chronic diseases that are associated with chronic oxidative stress and chronic inflammation. These chronic diseases include obesity, type 2 diabetes, hypertension, and atherosclerosis.

The ellagic acid found in raspberries deserves special mention as an anti-inflammatory compound. This phytonutrient has been shown to help prevent overactivity of certain pro-inflammatory enzymes (including cyclo-oxygenase 2, or COX-2) as well as their overproduction. In animal studies, intake of ellagic acid has been shown to reduce numerous aspects of unwanted and excessive inflammation, including aspects associated with Crohn's disease.

Obesity and Blood Sugar Benefits

Perhaps the most fascinating new areas of research on raspberries involve management of obesity and type 2 diabetes. In the case of obesity, two compounds in raspberries have received special focus: raspberry ketone (also called rheosmin) and a type of flavonoid called tiliroside.

Raspberry ketone is a compound that naturally occurs in raspberries, but unlike its name suggests, it is by no means exclusive to this fruit. Raspberry ketone is contained in a wide variety of plants, although not usually in such sizable amounts as are found in raspberries. Turkish rhubarb is one such plant. Larch, yew, maple, and pine are trees that contain amounts of raspberry ketone, and in some studies, pine needles have been used as a source of this compound for experimental purposes.

The chemical name for raspberry ketone is 4-(4-hydroxyphenyl) butan-2-one. Researchers are equally familiar with raspberry ketone under the name of rheosmin, and since 1965, it's been included on the Food and Drug Administration's (FDA's) Generally Recognized As Safe (GRAS) list as an approved food additive. The primary use of rheosmin as a food additive has been for flavor and aroma.

The rheosmin found in raspberries can increase metabolism in our fat cells by increasing enzyme activity, oxygen consumption, and heat production in certain types of fat cells. By boosting fat metabolism in this way, we may be less likely to deposit fat in our fat cells, and we may be able to use up some of the fat that is stored there. By improving our fat cell metabolism, we may also be able to reduce the number of pro-inflammatory messaging molecules that are produced by our fat cells. As a result, we may be less likely to experience some of the inflammation-based problems that typically accompany obesity.

In addition to these benefits, rheosmin found in raspberries can also decrease activity of a fat-digesting enzyme called pancreatic lipase that is produced by our pancreas. By decreasing the activity of this enzyme, we may digest and absorb less fat—another potential plus when trying to deal with the consequences obesity.

In addition to the rheosmin found in raspberries, scientists have also focused on the obesity-related benefits of a second compound called tiliroside. Tiliroside is a type of flavonoid (called a glycosidic flavonoid) that is found in many plants of the rose family, including rose hips, strawberries, and raspberries. In preliminary studies, tiliroside has been show to activate a special hormone called adiponectin that is produced by our fat cells. (The "adipo" part of this word means "fat," which is also why our fat cells are also called "adipocytes.")

In obese persons with type 2 diabates, adiponectin is not produced in sufficient amounts or, if adequately produced, remains too inactive. This inadequacy of adiponectin in obese persons with type 2 diabetes is a key problem for regulation of their blood sugar and blood fats. By activating adiponectin, the tiliroside in raspberries can help improve insulin balance, blood sugar balance, and blood fat balance in obese persons with type 2 diabetes. In studies to date, there is no indication that raspberry tiliroside will stop weight gain or prevent fat accumulation. But it may be able to help prevent unwanted consequences of too much body fat and compromised regulation of blood sugar, blood insulin, and blood fats.

Within this context of obesity and blood sugar regulation, another aspect of raspberry phytonutrients has captured the attention of researchers involving the ability of raspberry extracts to block activity of an enzyme called alpha-glucosidase. Alpha-glucosidase is a starch-digesting enzyme, and when it becomes active in the digestive tract, it increases the breakdown of starches into sugars. These sugars get absorbed up into the bloodstream and can cause excessively high levels of blood sugar following a meal. (This process is called postprandial hyperglycemia.) By blocking activity of alpha-glucosidase, raspberry extracts may make it possible for persons with type 2 diabetes (or obese persons experiencing problems with blood sugar regulation) to better manage their blood sugar levels.

We've been asked about the exact glycemic idex (GI) value for raspberries, and unfortunately, have not been able to find food research substantiation for any exact value. We've seen estimates for many berries that fall into the 40-50 GI range, and for most researchers, that would place them in the low GI category. Since one cup of fresh raspberries provides about 15 grams of total carbohydrates and only 5-6 grams of sugar (compared with 8 grams of dietary fiber), a modest serving of fresh raspberries (for example, 1/2 cup) is likely to be a very good fit in most diets, even diets focused on stabilization of blood sugar.

Anti-Cancer Benefits

Given the rich antioxidant and anti-inflammatory phytonutrient mixture found in raspberries, it's not surprising to see studies showing raspberry benefits in cancer prevention. Chronic excessive oxidative stress and chronic excessive inflammation can combine to trigger the development of cancer cells in a variety of human tissue. By providing a rich supply of antioxidants, raspberries can help lower risk of oxidative stress, and providing a rich supply of anti-inflammatory nutrients, raspberries can help lower the risk of excessive inflammation. When combined, these results mean decreased risk of cancer formation. In animal studies to date, the cancer types most closely examined in relationship to raspberry intake are cancers of the breast, cervix, colon, esophagus, and prostate.

Recent studies suggest that the anti-cancer benefits of raspberries may extend beyond their basic antioxidant and anti-inflammatory aspects. Phytonutrients in raspberries may also be able to change the signals that are sent to potential or existing cancer cells. In the case of existing cancer cells, phytonutrients like ellagitannins in raspberries may be able to decrease cancer cell numbers by sending signals that encourage the cancer cells to being a cycle of programmed cell death (apoptosis). This signaling is likely to involve activity of the p53 protein that is typically classified as a tumor suppressor protein.

In the case of potentially but not yet cancerous cells, phytonutrients in raspberries may be able to trigger signals that encourage the non-cancerous cells to remain non-cancerous. The role of the a protein complex called nuclear factor kappa B (NFkB) is likely to be involved in this set of events.

Description

Raspberries belong to the rose (*Rosaceae*) family of plants, which houses some of the world's most beloved fruits including apples, apricots, blackberries, cherries, loquats, peaches, pears, plums, and strawberries. Almonds also belong to this diverse family of plants. Among U.S. consumers, raspberries are the third most popular berry and follow right after strawberries and blueberries.

There are over 200 species of raspberries, all belonging to the scientific genus called *Rubus*. Fortunately, however, many of the raspberry species that are grown commercially can be placed into one of three basic groups: red raspberries, black raspberries, and purple raspberries.

Like their name implies, mature red raspberries can typically be identified by the shade of red in their color, although this red may veer toward the pinkish side. Among all commercially cultivated raspberries, *Rubus idaeus* or European red raspberry is among the most common.

Black raspberries may actually be dark enough to be indistinguishable from blackberries in terms of color. Here one of the most common commercially grown species is *Rubus occidentalis*, also sometimes referred to as thimbleberry, scotch cap, or black cap.

The third category of raspberry—purple raspberry—is a category in which reds and blacks have been hybridized (naturally combined). Over time, when red raspberries or black raspberries underwent naturally genetic mutations, yellow raspberries also developed. Even though naturally yellow or golden in color, yellow raspberries are actually special forms of red or black raspberries.

In science terms, raspberries are referred to as "aggregate fruits." Aggregate fruits are actually composed of many small individual fruits that come from multiple ovaries in a single flower. In the case of a raspberry, those small individual fruits are the little juicy spheres that make up the structure of the raspberry. They are also called drupelets, and each one has its own seed.

The word "bramble" refers to the prickly or thorny nature of a plant, and raspberries are sometimes referred to by raspberry growers as "brambles" (even though some species do not have thorns). The bramble nature of the raspberry plant comes into play on a regular basis for raspberry growers. Although the root system of raspberry plants can last for many years, the canes themselves are typically pruned twice a year to allow for spring and fall fruiting.

History

Scientists aren't entirely sure about the origins of raspberries. Wild raspberries appear on at least five continents, and there is enormous species diversity for this fruit. Some arctic species of raspberry are native to Alaska, the Aleutian Islands, and northern Asia; other species are native to eastern Asia and the Hawaiian islands; still others are native to Europe or to North America. In terms of their first cultivation, we have evidence dating back about 2,000 years in Europe, making raspberries one of the earliest berry crops. Natural trading and traveling may have been important in the spread of raspberries, for example, into North American from eastern Asia across the Bering Strait.

Interestingly, when cultivated raspberries are compared with wild raspberries, they turn out to be quite similar in terms of total phenols and total anthocyanin content. This similarity is especially true when the cultivated raspberries have also been organically grown. Although we might tend to think about a "wild" food as being more rich in nutrients than a cultivated food, this distinction does not hold true for raspberries when it comes to their phenol and anthocyanin antioxidants.

Today, raspberries rank high on the list of the world's most popular berries. Among the 400,000 metric tons of raspberries produced worldwide, Russia, the United States, Serbia, Poland, and Chile rank among the top producers. In the United States, it's the West Coast that is most active in raspberry production, although commercial producers can be found across the country. Interestingly, well over 500 organic farms in the U.S. are now certified for organic raspberry production, and raspberries rank as the third most popular fresh-use berry in the U.S. following strawberries and blueberries. The U.S. also imports about 15,000 metric tons of raspberries from Mexico to meet consumer demand for this fruit.

How to Select and Store

As raspberries are highly perishable, they should only be purchased one or two days prior to use. The goal when purchasing this fruit is to choose berries that are fully ripe without being overly so. Choose berries that are firm, plump, and deep in color, while avoiding those that are soft, mushy, or moldy. If you are buying berries prepackaged in a container, make sure that they are not packed too tightly, since this may cause them to become crushed and damaged, and that the container has no signs of stains or moisture, indications of possible spoilage. Within the U.S., raspberries are generally available from mid-summer through early fall.

Raspberries are a highly perishable fruit, so extra care should be taken in their storage. If you do not plan to eat your raspberries upon arrival back at home, they should be stored in your refrigerator. Before storing in the refrigerator, remove any berries that are molded or spoiled so that they will not contaminate the others. Place the unwashed berries back in their original container or spread them out inside of a glass or plastic container that has a lid and can be sealed. Raspberries will keep fresh in the refrigerator for one or two days. When taking your raspberries out of the refrigerator for consumption, try not to leave them at room temperature any longer than necessary (one to two hours), and also try to avoid placing them directly in strong sunlight. These steps will help prevent spoilage.

Raspberries freeze very well. Wash them gently using the low pressure of the sink sprayer so that they will maintain their delicate shape and then pat dry with a paper towel. Arrange them in a single layer on a flat pan or cookie sheet and place them in the freezer. Once frozen, transfer the berries to a heavy plastic freezer bag or plastic freezer container that can be sealed and return them to the freezer where they will keep for up to one year.

Within this context of How to Select and Store, we would like to point out the often dramatic differences we've seen between whole raspberries and products containing processed forms of raspberries. Unless provided with information from the manufacturer, it's difficult to be sure that you are getting substantial raspberry benefits from products that contain raspberries in processed forms. Processing in this case may include drying, juicing, fermenting into wine, straining, or filtering. For example, if the seeds of the raspberries have been removed during processing, many key phytonutrients may be lost or greatly reduced. Exposures to heat during processing may also result in substantial phytonutrient loss. We've seen studies that make us cautious about the preservation of nutrient richness in most processed forms of raspberry, including wines produced in the absence of seeds, baby foods produced with the use of heat and filtering, and commercial drying of raspberry for creation of an industrially versatile powdered form. While there are ways to make wine and baby food and other raspberry-containing products that avoid great damage to raspberry phytonutrients, it can be difficult to determine how careful manufacturers have been in their food production. For this reason, we recommend that you stick with whole raspberries in fresh or frozen form when purchasing them at the grocery and incorporate them into recipes using the minimal type of processing that you would be undertaking in your own kitchen.

How to Enjoy

A Few Quick Serving Ideas

- Mix fresh raspberries in with creamy millet porridge for a sweet morning breakfast treat.
- While at first glance it may seem unusual, the flavor combination created by sprinkling fresh raspberries with balsamic vinegar will send your palate to heaven.
- Plain yogurt mixed with raspberries, honey, and freshly chopped mint is delicious eaten as is or used as a topping for waffles or pancakes.
- Depending upon how much sweetener you use, homemade raspberry coulis can be used as a sauce for either savory poultry dishes or sweet desserts.

WHFoods Recipes That Feature Raspberries

- Granola with Fresh Fruit
- 10 Minute Fresh Berry Dessert with Yogurt & Chocolate
- 5-Minute Raspberry Almond Parfait
- Berries with Chocolate Sauce

For some of our favorite recipes, click Recipes.

Safety

Raspberry Fruits Compared to Raspberry Leaf

In this Individual Concerns section, we would like to make one additional note about the difference between raspberry fruit and raspberry leaf. Raspberry leaf has a long history of use in botanical medicine and is widely available in the U.S. and other countries in tea form. While raspberry leaf has been used to support function in various body systems (including the digestive tract), it's best-known use has been in conjunction with pregnancy and childbirth. While these medically related uses of raspberry *leaf* may be well worth discussing with your healthcare practitioner, it's important to treat them as separate and distinct from the benefits of raspberry *fruit* as ordinarily consumed in whole food form.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Raspberries, fresh
1.00 cup
123.00 grams

Calories: 64
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin C	32.23 mg	43	12.1	excellent
manganese	0.82 mg	41	11.5	excellent
fiber	7.99 g	32	9.0	excellent
copper	0.11 mg	12	3.4	very good
vitamin K	9.59 mcg	11	3.0	good
pantothenic acid	0.40 mg	8	2.3	good
biotin	2.34 mcg	8	2.2	good
vitamin E	1.07 mg (ATE)	7	2.0	good
magnesium	27.06 mg	7	1.9	good
folate	25.83 mcg	6	1.8	good
omega-3 fats	0.15 g	6	1.8	good
potassium	185.73 mg	5	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Strawberries

What's New and Beneficial About Strawberries

- Many foods commonly consumed in the U.S. are valuable sources of antioxidants. But researchers have recently ranked the 50 best antioxidant sources among commonly eaten foods and found strawberries to be quite exceptional. When total antioxidant capacity was measured against a uniform amount of food (100 grams, or about 3.5 ounces), strawberries ranked 27th best among U.S. foods. In addition, when only fruits were considered, strawberries came out 4th among all fruits (behind blackberries, cranberries, and raspberries). However, since many foods (for example, spices and seasonings) are seldom consumed in amounts as large as 3.5 ounces, researchers also looked at common serving sizes for all foods and their total antioxidant capacity. In this evaluation based on common serving sizes, strawberries came out 3rd among all U.S. foods including spices, seasonings, fruits, and vegetables! (In this analysis based on serving size, only blackberries and walnuts scored higher in total antioxidant capacity.) When we hear the word "strawberry," we might think about a very commonplace fruit. But the antioxidant capacity of strawberry is anything but common!
- Recent research has shown strawberries to be a surprisingly fragile, perishable, and delicate fruit. Food scientists recently took a close look at storage time, storage temperature, storage humidity, and degree of strawberry ripeness and found significant differences between different types of strawberry storage. On average, studies show 2 days as the maximal time for strawberry storage without major loss of vitamin C and polyphenol antioxidants. It's not that strawberries become dangerous to eat or invaluable after 2 days. It's just that more storage time brings along with it substantially more nutrient loss. In terms of humidity, 90-95% has been shown optimal. Most refrigerators will average a much lower humidity (between 80-90%). Because air circulation inside the fridge can lower humidity, you may want to give your strawberries more storage humidity by putting them in your refrigerator's cold storage bins (if available). Those cold storage bins will help boost humidity by reducing air circulation. If your fridge does not have storage bins, you can use a sealed container for refrigerator storage of your strawberries. Optimal temperature for strawberry storage over a 2-day period has been found to be relatively cold—36F (2C). All public health organizations recommend refrigerator temperatures of 40F (4.4C) as the maximum safe level for food storage. However, if you are storing sizable amounts of fruits and vegetables—including strawberries—in your refrigerator, you may want to consider setting your refrigerator to a lower-than-maximum temperature setting in the range of 36-38F (2-3C). In terms of ripeness, recent studies have found that both underripeness and overripeness can have an unexpectedly large impact on the phytonutrient content of strawberries, especially their antioxidant polyphenols. Fortunately, optimal strawberry ripeness can be judged by color. You'll want to consume your strawberries when their amazing pinkish-red color is most vibrant and rich in luster.
- Improved blood sugar regulation has been a long-standing area of interest in research on strawberries and health. However, scientists have recently discovered a fascinating relationship between intake of strawberries, table sugar, and blood sugar levels. As you might expect, excess intake of table sugar (in a serving size of 5-6 teaspoons) can result in an unwanted blood sugar spike. But you might not expect this blood sugar spike to be reduced by simultaneous consumption of strawberries! Yet that's exactly what researchers have discovered. With the equivalent of approximately one cup of fresh strawberries (approximately 150 grams), blood sugar elevations from simple sugar intake can be reduced. These health science researchers have further speculated that polyphenols in strawberries played a major role in helping regulate blood sugar response. This finding is great news for healthy persons wanting to maintain healthy blood sugar levels, and also for persons with type 2 diabetes who enjoy fresh strawberries and want to enjoy them on a regular basis.
- Given their amazing combination of phytonutrients—including anthocyanins, ellagitannins, flavonols, terpenoids, and phenolic acids—it's not surprising to find increasing research interest in the anti-inflammatory properties of strawberries. But it's still exciting to see this remarkable fruit lowering levels of inflammatory markers like C-reactive protein (CRP) when consumed several days per week in everyday amounts of approximately one cup. Recent research has shown that several blood markers for chronic, unwanted inflammation can be improved by regular intake of strawberries. Interestingly, in one large-scale study, consumption of strawberries did not show anti-inflammatory benefits until strawberries were consumed at least 3 times per week. This research is one of the reasons we recommend inclusion of berries at least 3-4 times per week in your overall fruit intake.

WHFoods Recommendations

In our Healthiest Way of Eating Plan, we encourage the consumption of 5-10 servings of fruits-plus-vegetables (combined) each day. We believe that the balance between fruits and vegetables can vary from day to day, depending upon personal health factors, personal taste preferences, and optimal combining of foods in recipes as well as meals. We recognize that our recommendation calls for a more generous amount of fruits and vegetables than the amount recommended by the Centers for

Disease Control (CDC) at the U.S. Department of Health and Human Services (DHHS). The CDC recommends between 1.5-2.5 cups of fruit and 2.5-4.0 cups of vegetables per day, as well as a target goal of at least 5 fruit-plus-vegetable servings (combined) per day.

With respect to berries, the CDC approach provides the example of strawberries and explains that 8 large strawberries count as 1 cup. If all fruit for the day were to be obtained from strawberries, the CDC recommendation would translate into 12-20 strawberries for the day as a way of meeting a requirement for 1.5-2.5 cups of fruit.

We recommend that you set your fruit goals higher than these CDC amounts. Based on the scientific research, we believe it's going to take closer to 3 fruit servings per day to provide you with optimum health benefits. With respect to berries in particular, we recommend that you include berries at least 3-4 times per week within your fruit servings.

In several of our sample meal plans, we include berries on a daily basis! It would definitely not be a mistake for you to include a serving of berries in your daily meal plan! At the same time, we recognize that the fruit group contains many outstanding fruit options, and personal preferences (as well as local and seasonal availability) can vary greatly. Also, remember that large strawberries--at about 18 grams per berry and 8 berries per cup--stand at one end of the berry range in terms of size and recommended amount. Most berries are considerably smaller in size and weight, and a one-cup serving allows you to eat a lot more berries! With blueberries, for example, the average weight per berry is closer to 1-2 grams, and a cup's worth of blueberries means about 100-150 berries. For cranberries and raspberries, the amount would be similar.

The fragrantly sweet juiciness and deep red color of strawberries can brighten up both the taste and aesthetics of any meal. Not only do they taste great they are among the fruits and vegetables ranked highest in health-promoting antioxidants. Antioxidants help combat the damaging effects of free radical activity to cellular structures and DNA. Like the other World's Healthiest Fruits, we recommend enjoying strawberries raw (not in baked/cooked desserts) because they provide you with the best flavor and the greatest benefits from their vast array of nutrients and digestion-aiding enzymes. Peoples around the world have long been eating fruit for dessert, not only as a delicious ending to a meal but as a great digestive aid as well. For more on the Healthiest Way of Preparing Strawberries, see below.

Strawberries, fresh
1.00 cup
(144.00 grams)

Calories: 46
GI: low

Nutrient	DRI/DV
vitamin C	113%
manganese	28%
fiber	12%
iodine	9%
folate	9%
copper	8%
potassium	6%
magnesium	5%
phosphorus	5%
biotin	5%
omega-3 fats	4%
vitamin B6	4%

Health Benefits

Given their unique combination of antioxidant and anti-inflammatory nutrients, it's not surprising to see strong research support for strawberry health benefits in three major areas: (1) cardiovascular support and prevention of cardiovascular diseases (2) improved regulation of blood sugar, with decreased risk of type 2 diabetes, and (3) prevention of certain cancer types including breast, cervical, colon, and esophageal cancer. In this section, we'll review the outstanding research-based benefits of strawberries in each area.

Cardiovascular Benefits

No area of strawberry health benefits is better documented than benefits for the cardiovascular system. It's also hard to imagine any other research result, since our heart and blood vessels need everyday protection from oxidative and inflammatory damage, and the antioxidant and anti-inflammatory nutrient content of strawberries is simply outstanding. Among all fruits profiled as the World's Healthiest Foods, strawberries come out as the best fruit source of a pivotal antioxidant vitamin:

vitamin C in several nationwide studies conducted in different countries. In one study that surveyed 66 different fruits consumed by adults in Iran, strawberries not only emerged as the best fruit source of vitamin C, but a source that provided more than twice as much vitamin C (47 milligrams versus 18 milligrams in 3.5 ounces) than the average for fruits as a group. After raspberries and grapes, strawberries also rank among the best fruit sources of manganese among the World's Healthiest Foods. Because of its key role as a cofactor for antioxidant enzyme activity by the enzyme superoxide dismutase (SOD), manganese is considered to be a key antioxidant mineral. Yet, strawberries "claim to fame" in the antioxidant department is really reserved for their phytonutrient content.

Many of the phytonutrients present in strawberries function not only as antioxidants but also as anti-inflammatory nutrients. The chart below shows several of the more important antioxidant and anti-inflammatory nutrients present in fresh, ripe strawberries:

Antioxidant and Anti-Inflammatory Phytonutrients in Strawberries

(* indicates that these are typically in small or trace amounts)

- Anthocyanins
  - cyanidins
  - pelargonidins
- Flavonols
  - procyanidins
  - catechins
  - gallocatechins
  - epicatechins
  - kaempferol
  - quercetin
- Hydroxy-benzoic acids
  - ellagic acid
  - gallic acid
  - vanillic acid*
  - salicylic acid
- Hydroxy-cinnamic acids
  - cinnamic acid
  - coumaric acid
  - caffeic acid
  - ferulic acid
- Tannins
  - ellagitannins
  - gallotannins
- Stilbenes
  - resveratrol

Several research studies have shown that these diverse strawberry phytonutrients actually work together in synergistic fashion to provide their cardiovascular benefits. Decreased oxidation of fats (lipid peroxidation) in the cell membranes of cells that line our blood vessels; decreased levels of circulating fats, including total cholesterol and LDL cholesterol; and decreased activity of angiotensin I-converting enzyme (ACE), an enzyme whose overactivity increases our risk of high blood pressure are results that have all been documented following daily intake of strawberries over 1-3 months period of time. Amounts of strawberries in most studies were equivalent to 1-2 cups of strawberries per day.

Blood Sugar Benefits

One of the more recent areas of health benefit to be documented in strawberry research is the area of blood sugar benefits. Several recent studies have found regular intake of strawberries to be associated with decreased risk of type 2 diabetes. In some of these studies, frequency of strawberry intake definitely seems to matter since an intake frequency of once per week or less is not associated with blood sugar benefits in some studies. In these studies, significant benefits do not emerge until frequency of intake reaches at least 2-3 strawberry servings per week.

Of special interest for blood sugar regulation is the relationship recently documented by researchers between intake of strawberries, intake of table sugar, and resulting blood sugar levels. As you might expect, excess intake of table sugar (in a serving size of 5-6 teaspoons) was able to produce an unwanted blood sugar spike in study participants during this study. But as you might not expect, this blood sugar spike was actually reduced by simultaneous consumption of strawberries. Approximately one cup of fresh strawberries (approximately 150 grams) was able to decrease blood sugar elevations when table sugar was consumed along with strawberries. The investigators speculated that polyphenols in strawberries played a major role in helping regulate blood sugar response. One particular type of polyphenol in strawberries—ellagitannins—might have been especially important for this blood sugar-relating benefit. Ellaginannins are polyphenols that are known to inhibit the activity of an enzyme called alpha-amylase. Since this enzyme is responsible for breaking amylose starches into simple sugars, fewer simple sugars might be released into the blood stream when activity of this enzyme is reduced.

Anti-Cancer Benefits

Since chronic, excessive inflammation and chronic, excessive oxidative stress (lack of antioxidant nutrients and unsupported oxygen metabolism) are often primary factors in the development of cancer, strawberries would definitely be expected to have cancer risk-lowering properties given their outstanding antioxidant and anti-inflammatory nutrient content. Anti-cancer benefits from strawberries are best documented in the case of breast, cervical, colon, and esophageal cancer. Most of the tumor-inhibiting studies on animals have focused on the phytonutrient content of strawberries. Among the strawberry phytonutrients, ellagic acid and ellagitannins in strawberry have emerged as anti-cancer substances of special interest. While the anti-cancer (chemopreventive) properties of these phytonutrients have yet to be fully understood, their ability to lower risk for some forms of cancer may be related to their ability to boost the activity of antioxidant enzymes like catalase or superoxide dismustase, their ability to lessen the activity of pro-inflammatory enzymes like cyclo-oxygenase 2 (COX-2), or their ability to lessen expression of the enzyme inducible nitric oxide synthase (iNOS). Whatever the mechanism or combination of mechanisms, strawberries are likely to bring anti-cancer health benefits to your diet.

Other Health Benefits

A growing area of health research on strawberries is the area of aging and aging-related events. Several preliminary studies on intake of strawberries on aged animals has shown enhanced cognitive function (in the form of better object recognition) following ingestion of a diet with 2% of the calories provided by strawberry extracts. Enhanced motor function (in the form of better balance and coordination of movements) has also been shown in these strawberry extract studies. Some of the strawberry impact in these aging studies has been attributed to the ability of strawberry phytonutrients to lower the presence of pro-inflammatory messaging molecules like nuclear factor kappa-B.

Improvement of inflammatory bowel problems—including ulcerative colitis and Crohn's disease—has also been demonstrated in preliminary studies on animals with daily strawberry extract or strawberry powder intake. Interestingly, even though strawberries contain relatively small amounts of salicylic acid (an anti-inflammatory compound very similar to the acetylsalicylic acid of aspirin), some researchers have suggested that this naturally-occurring anti-inflammatory substance in strawberries might be partly responsible for decreased inflammation in the digestive tract of individuals diagnosed with inflammatory bowel diseases like ulcerative colitis or Crohn's disease.

Inflammation-related arthritis (including rheumatoid arthritis), and inflammation-related diseases of the eye (including macular degeneration) are two additional areas in which strawberries may turn out to provide important health benefits. Even though health research in these areas is in a preliminary stage, the unique combination of anti-inflammatory phytonutrients in strawberries is likely to explain some of the key potential benefits in these areas.

Description

Fragrantly sweet strawberries are the most popular type of berry fruit in the world. Although they have become increasingly available year-round, they are at the peak of their season from April through July when they are the most delicious and most abundant.

While there are more than 600 varieties of strawberries that differ in flavor, size and texture, one can usually identify a strawberry by its red flesh that has small seeds piercing its surface, and a small, regal, green leafy cap and stem that adorn its crown. Most commercially grown strawberries come from the genus-species *Fragaria ananassa*. Cultivation of this particular genus-species has been taking place for nearly 300 years. Much older still, however, are wild strawberries that typically below to the genus-species *Fragaria vesca*. Wild strawberries are known to have existed for more than 2,000 years. While typically smaller in size than cultivated strawberries, wild strawberries often feature a more intense flavor. In the U.S., commercial strawberry production is largely limited to the coastal and southern inland regions of California and to the East Coast, where Florida production becomes especially important during the winter months. *Fragaria virginiana* is a popular genus-species of strawberry grown in the U.S. along side of the genus-species *Fragaria ananassa*.

History

Strawberries have grown wild for millennia in temperature regions throughout the world. While cultivation of strawberries doesn't date back this far, it still dates back hundreds and hundreds of years.

It was not until the 18th century, however, when cultivation of strawberries began to be pursued in earnest. In 1714, a French engineer sent to Chile and Peru to monitor Spanish activities in these countries "discovered" a strawberry native to this region that was much larger than those grown in Europe. He brought many samples back to France, which were subsequently planted. These plants did not originally flourish well until a natural crossbreeding occurred between this species and a neighboring North American strawberry variety that was planted nearby in the field. The result was a hybrid strawberry that was large, juicy and sweet, and one that quickly grew in popularity in Europe.

The strawberry, like many other perishable fruits at this time, remained a luxury item only enjoyed by the wealthy until the mid-19th century. Once railways were built and more rapid means of transportation established, strawberries were able to be shipped longer distances and were able to be enjoyed by more people. Today, using a commonplace, layperson's definition of the word "berry," the strawberry has become the most popular berry fruit in the world. (In technical scientific terms, this distinction would go to bananas, since their seeds and pulp produced from a single ovary, and that characteristic is used to classify berries versus non-berries. In fact, when considered from a technical scientific standpoint, strawberries are not berries at all, but rather "accessory fruits" in which the delicious substance that we eat is not directly produced from the ovary. But for most of us, despite these technical scientific distinctions, strawberries count as some of the best berries ever!)

How to Select and Store

As strawberries are very perishable, they should only be purchased a few days prior to use. Choose berries that are firm, plump, free of mold, and which have a shiny, deep red color and attached green caps. Since strawberries, once picked, do not ripen further, avoid those that are dull in color or have green or yellow patches since they are likely to be sour and of inferior quality. Full ripe berries will not only have the peak flavor and texture, but will have more nutrients. "Full ripe" in this case means optimally ripe, not overripe. Both underripe and overripe strawberries have been show to have lower vitamin C content and decreased phytonutrient content in comparison to optimally ripe strawberries.

We believe that the surprisingly fragile and perishable nature of strawberries is especially important!

Food scientists have recently taken a close look at storage time, storage temperature, storage humidity, and degree of strawberry ripeness and found significant differences among their impact upon nutrient retention. On average, studies show 2 days as the maximal time for strawberry storage without major loss of vitamin C and polyphenol antioxidants. It's not that strawberries become dangerous to eat or invaluable after 2 days. It's just that more storage time brings along with it substantially more nutrient loss. In terms of humidity, 90-95% has been shown to be optimal. Most refrigerators will average a much lower humidity (between 80-90%). Because air circulation inside the fridge can lower humidity, you may want to give your strawberries more storage humidity by putting them in your refrigerator's cold storage bins (if available). Those cold storage bins will help boost humidity by reducing air circulation. If your refrigerator does not have storage bins, you can use a sealed container for refrigerator storage of your strawberries. Optimal temperature for strawberry storage over a 2-day period has been found to be relatively cold—36F (2C). All public health organizations recommend refrigerator temperatures of 40F (4.4C) as the maximum safe level for food storage.

However, if you are storing sizable amounts of fruits and vegetables—including strawberries—in your refrigerator, you may want to consider setting your refrigerator to a lower-than-maximum temperature setting in the range of 36°-38°F (2°-3°C).

Medium-sized strawberries are often more flavorful than those that are excessively large. If you are buying strawberries prepackaged in a container, make sure that they are not packed too tightly (which may cause them to become crushed and damaged) and that the container has no signs of stains or moisture, indication of possible spoilage. Strawberries are usually available year round, although in greatest abundance from the spring through the mid-summer.

The very fragile nature of strawberries means that great care should be taken in their handling and storage. Before storing in the refrigerator, remove any strawberries that are molded or damaged so that they will not contaminate others. Place the unwashed and unhulled berries in a sealed container to prevent unnecessary loss of humidity. Strawberries will maintain excellent nutrient content if properly stored in a refrigerator for two days. Make sure not to leave strawberries at room temperature or exposed to sunlight for too long, as this will cause them to spoil.

To freeze strawberries, first gently wash them and pat them dry. You can either remove the cap and stem or leave them intact, depending upon what you will do with them once they are thawed. Arrange them in a single layer on a flat pan or cookie sheet and place them in the freezer. Once frozen, transfer the berries to a heavy plastic bag and return them to the freezer where they will keep for up to one year. Adding a bit of lemon juice to the berries will help to preserve their color. While strawberries can be frozen whole, cut or crushed, they will retain a higher level of their vitamin C content if left whole.

Commercial food processing can dramatically lower the nutrient content of strawberries, especially their phytonutrient content. For example, we've seen several studies showing very little retention of certain anthocyanin phytonutrients in baby foods made from strawberries or other brightly-colored berries. The dramatic impact of some processing methods may be to do heat, pH (changes in acidity during processing), oxygen exposure, light exposure, the physical and mechanical impact of processing, or a combination of these factors. In any case, a much safer bet in terms of strawberries and nourishment is to stick with fresh berries or carefully frozen berries, and in the case of baby food or the feeding of young children, to purée the berries in a blender so that overall processing is kept to a minimum.

How to Enjoy

A Few Quick Serving Ideas

- Add sliced strawberries to mixed green salad.
- Layer sliced strawberries, whole blueberries and plain yogurt in a wine glass to make a parfait dessert.
- Blend strawberries with a little bit of orange juice and use as a refreshing coulis sauce.
- Add strawberries to breakfast shakes to give them a more vibrant taste and texture.

WHFoods Recipes That Feature Strawberries

- Strawberry Smoothie
- 10 Minute Fresh Berry Dessert with Yogurt & Chocolate
- 10-minute Kiwi Mandala
- 10-Minute Strawberries with Chocolate Creme
- Grapefruit Sunrise

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Strawberries, fresh
1.00 cup
144.00 grams

Calories: 46
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin C	84.67 mg	113	44.1	excellent
manganese	0.56 mg	28	10.9	excellent
fiber	2.88 g	12	4.5	very good
iodine	12.96 mcg	9	3.4	very good
folate	34.56 mcg	9	3.4	very good
copper	0.07 mg	8	3.0	good
potassium	220.32 mg	6	2.5	good
biotin	1.58 mcg	5	2.1	good
phosphorus	34.56 mg	5	1.9	good

magnesium	18.72 mg	5	1.8	good
vitamin B6	0.07 mg	4	1.6	good
omega-3 fats	0.09 g	4	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Watermelon

What's New and Beneficial About Watermelon

- Alongside of tomatoes, watermelon has moved up to the front of the line in recent research studies on high-lycopene foods. Lycopene is a carotenoid phytonutrient that's especially important for our cardiovascular health, and an increasing number of scientists now believe that lycopene is important for bone health as well. Among whole, fresh fruits that are commonly eaten in the U.S., watermelon now accounts for more U.S. intake of lycopene (by weight of fruit eaten) than any other fruit. Pink grapefruit and guava are two other important fruit sources of lycopene, although in the U.S., these fruits are more often consumed in the form of juice.
- Health scientists are becoming more and more interested in the citrulline content of watermelon. Citrulline is an amino acid that is commonly converted by our kidneys and other organ systems into arginine (another amino acid). The flesh of a watermelon contains about 250 millligrams of citrulline per cup. When our body absorbs this citrulline, one of the steps it can take is conversion of citrulline into arginine. Particularly if a person's body is not making enough arginine, higher levels of arginine can help improve blood flow and other aspects of our cardiovascular health. There's also some preliminary evidence from animal studies that greater conversion of citrulline into arginine may help prevent excess accumulation of fat in fat cells due to blocked activity of an enzyme called tissue-nonspecific alkaline phosphatase, or TNAP.
- If you've gotten used to thinking about the juicy red flesh at the center of a watermelon as its only nutrient-rich area—and far more nutrient-rich than the more lightly-colored flesh that is farther out near the watermelon rind—it is time to change your thinking. In a recent study, food scientists compared the nutrient content of flesh from different parts of a watermelon: flesh from the center, the stem end, the blossom end (opposite from the stem), and the periphery (the part nearest to the rind). What they've discovered were impressive concentrations of phenolic antioxidants, flavonoids, lycopene, and vitamin C in all of these different areas. The exact distribution of nutrients was also highly dependent on the variety of watermelon. But there was no area in any of the watermelon varieties that came out badly in terms of nutrients, and in many of the watermelon varieties, the flesh's outer periphery contained impressive concentrations of most nutrients.
- Recent studies have confirmed the nutritional importance of allowing a watermelon to fully ripen. For example, research has shown that the biggest jump in lycopene content occurs at the time when a watermelon's flesh turns from white-pink to pink. Yet when that flesh continues to ripen, resulting in a color change from pink to red, the lycopene content becomes even more concentrated. Prior to ripening, when the flesh of a watermelon is primarily white in color, its beta-carotene content is near zero. Even when allowed to ripen to the white-pink stage, a watermelon still contains very little of its eventual beta-carotene content. But as it moves from white-pink to pink to red, the beta-carotene content of a watermelon steadily increases. Like lycopene and beta-carotene, total phenolic antioxidants in a watermelon also increase consistently during ripening, all the way up until the appearance of fully red flesh. The bottom line: eating a fully ripe watermelon can really pay off in terms of nutrient benefits. Please see our section called "How to Select and Store" to learn about determining a watermelon's ripeness before you purchase it.

Watermelon, diced, fresh
1.00 cup
(152.00 grams)

Calories: 46
GI: medium

Nutrient	DRI/DV
vitamin C	16%
pantothenic acid	7%
copper	7%
vitamin A	5%
potassium	5%
biotin	5%
magnesium	4%
vitamin B6	4%
vitamin B1	4%

Health Benefits

Anti-Inflammatory and Antioxidant Support

Phenolic compounds in watermelon—including flavonoids, carotenoids, and triterpenoids—make this fruit a choice for anti-inflammatory and antioxidant health benefits. If you had to pick a single nutrient from this anti-inflammatory and antioxidant category that has put watermelon on the map, that nutrient would be lycopene. Alongside of pink grapefruit and guava, watermelon is an unusually concentrated source of this carotenoid. Whereas most fruits get their reddish color from anthocyanin flavonoids, watermelon gets it reddish-pink shades primarily from lycopene. The lycopene content of watermelons increases along with ripening, so to get the best lycopene benefits from watermelon, make sure that your melon is optimally ripe. (See our section entitled, "How to Select and Store" for practical tips on selecting a fully ripe watermelon.) The lycopene in watermelon is a well-documented inhibitor of many inflammatory processes, including the production of pro-inflammatory messaging molecules, the expression of enzymes like cyclo-oxygenase and lipoxygenase that can lead to increased inflammatory response, and the activity of molecular signaling agents like nuclear factor kappa B (NFkB). Lycopene is also a well-known antioxidant, with the ability to neutralize free radical molecules.

Recent research has shown that the lycopene content of watermelon also remains very stable over time. When two-inch cubes of fresh-cut watermelon were stored in the refrigerator at 36°F (2°C) over 48 hours, researchers found virtually no deterioration in lycopene content. That deterioration did not start to become significant until about seven days of storage, when it decreased by about 6-11%. While we do not recommend waiting seven days before consuming fresh cut watermelon, we believe that the excellent stability of watermelon lycopene over a two-day period is great news for anyone wanting to enjoy fresh cut watermelon over the course of several days.

Cucurbitacin E is another unique anti-inflammatory phytonutrient (called a tripterpenoid) found in watermelon. Like the carotenoid lycopene, this anti-inflammatory nutrient has been shown to block activity of cyclo-oxygenase enzymes and neutralize reactive nitrogen-containing molecules. (Interestingly, cucurbitacin E does not appear to neutralize activity of reactive oxygen species—called ROS—but only activity of reactive nitrogen species, called RNS.)

Antioxidant carotenoids found in watermelon include significant amounts of beta-carotene. Like lycopene, the beta-carotene in watermelon also increases with ripening.

Red-pink fleshed watermelons typically contain far more lycopene and beta-carotene than yellow-white fleshed varieties. For example, one study we've seen showed red watermelon to contain over 600 micrograms of beta-carotene per 3.5 ounces of melon and over 6,500 micrograms of lycopene. By comparison, yellow-fleshed varieties were found to contain only 5-10 micrograms of beta-carotene and no measurable amount of lycopene. In red/pink-fleshed watermelons as a group, we've seen lycopene amounts that vary widely in a range of approximately 2,000–6,700 micrograms per 3.5 ounces of fresh melon. Beta-carotene in these red/pink-fleshed varieties also varies widely, in a range of approximately 5–325 micrograms. Because watermelon contains so many different phytonutrients—as well as key vitamins and minerals, as well as dietary fiber—your health is going to be improved by any watermelon variety that you choose. However, if you specifically want to maximize your lycopene and beta-carotene intake, you'll most likely want to stick with red/pink-fleshed varieties of watermelon.

It would be a mistake to ignore the important amount of vitamin C found in watermelon. In our Food Rating System, watermelon qualifies as very good source of vitamin C, even though the amount provided (about 12 milligrams per cup of fresh melon) is only 16% of the Dietary Reference Intake (DRI). However, due to its very high water content, the same amount of watermelon that provides us with 16% of the DRI for vitamin C only costs us about 46 calories, or about 2% of our total daily calories on a 1800-2000 calorie diet. That's excellent nutrient richness, and it makes watermelon a great choice for increasing vitamin C antioxidant protection.

Citrulline, Arginine, and Nitric Oxide-Related Benefits

One of the more unusual aspects of watermelon is its rich supply of the amino acid, citrulline. Citrulline is an amino acid that is commonly converted by our kidneys and other organ systems (including cells that line our blood vessels) into arginine (another amino acid). The flesh of a watermelon contains about 250 millligrams of citrulline per cup. When our body absorbs citrulline, one of the steps it can take is conversion of citrulline into arginine.

An enzyme called nitric oxide synthase (NOS)—found in many of our body's cell types—is able to take the amino acid arginine and use it to help produce a very small molecule of gas called nitric oxide (NO), which is a muscle relaxant. For example, when NO tells the smooth muscles around our blood vessels to relax, the space inside our blood vessels can expand, allowing blood to flow more freely and creating a drop in blood pressure. The relaxing of muscle tension and increasing of blood flow is also the way that NO can change erectile function in men. (The prescription medication sildenafil or Viagra (TM) works in this way.)

The amount of citrulline found in fresh watermelon is not enough to make it a food that can automatically improve blood pressure or affect other problems like erectile dysfunction. But in animal studies, intake of watermelon has been shown to help support cardiovascular function, including improvement of blood flow (through relaxation of blood vessels, or what is technically called vasodilation). In humans, intake of watermelon has been shown to increase blood levels of arginine, but only when consumed in very large amounts. For example, in one study that we reviewed, participants consumed either three cups or six cups of fresh watermelon juice daily over the course of three weeks and experienced increases in their blood arginine levels of approximately 12-22%.

Another fascinating new area of research involving watermelon and its citrulline content relates to the deposition of body fat. In animal studies, high intake of amino acid citrulline—followed by conversion of citrulline into the amino acid arginine—can result in the formation of arginine-related molecules called polyarginine peptides. These polyarginine peptides are able to block activity of an enzyme called tissue-nonspecific alkaline phosphatase, or TNAP. When TNAP activity is shut down, our fat cells (adipocytes) tend to create less fat (adipogenesis). Researchers believe that the connection between citrulline in food, arginine production by nitric oxide synthase, and fat cell metabolism may eventually provide us with additional tools for helping prevent over-accumulation of body fat.

At present, however, the best we can conclude about watermelon and its unusual citrulline content is that it's likely to provide us with some cardiovascular benefits, especially if we don't consume many foods that are high in arginine. (Some of the WHFoods highest in arginine include shrimp, spinach, sea vegetables, turkey, sunflower seeds, and sesame seeds.)

Other Health Benefits

Watermelon seeds can provide us with small but helpful amounts of both iron and zinc. We're talking about several hundred seeds (the amount contained in a typical seeded watermelon, which is not an amount that we would anticipate or suggest eating at one time) to obtain 1–2 milligrams of either mineral. Still, regular consumption of whole, seeded watermelon would provide us with nutrient benefits in this area over time. Interestingly, we've seen one study showing that the iron and zinc in watermelon seeds is surprisingly bioavailable (85-90%), despite the oxalates and phytates that are contained in the seeds. (Oxalates and phytates can sometimes bind with minerals like iron and zinc to lessen their bioavailability.)

The amount of protein in watermelon seeds is approximately 1 gram per 24 seeds. At this rate, we're likely to get several grams of protein when we eat several slices of whole, seeded watermelon. While we would not want to depend on watermelon as a key protein food, this valuable amount of protein in its seeds should at least remind us that a fruit like watermelon does have something to offer us in the way of protein benefits.

At approximately two-thirds of one gram of dietary fiber per cup, watermelon does not rank as a good, very good, or excellent source of this nutrient in our ranking system. However, you'd be receiving about 3-4 grams of dietary fiber if you enjoyed 175–200 calories of fresh watermelon in the form of several large slices, and this dietary fiber would include a nice mix of soluble to insoluble fiber. (Insoluble fibers can provide special support to the digestive system, and soluble fibers can provide special support to the cardiovascular system.) So while watermelon is not a concentrated source of fiber, we often enjoy it in larger amounts that can provide us with great fiber benefits at a low calorie cost.

Description

If you have ever tasted a watermelon, it is probably no surprise to you why this juicy, refreshing fruit has this name. Watermelon has an extremely high water content, approximately 92%, giving its flesh a juicy and thirst-quenching texture while still also subtly crunchy. As a member of the *Cucurbitaceae* family, the watermelon is related to the cantaloupe, squash, pumpkin, cucumber, and gourd that grow on vines on the ground. Watermelons can be round, oblong, or spherical in shape and feature thick green rinds that are often spotted or striped. (Many people report, however, that they like the taste and predictable ripeness of a watermelon best if the watermelon is symmetrical in shape.) Watermelons range in size from a few pounds to upward of ninety pounds. Between 600–1,200 different varieties of watermelon exist worldwide, but all of these varieties belong to the same scientific genus and species of plant, called *Citrullis lanatus*.

While we often associate a deep red/pink color with watermelons, there are many varieties that feature orange, yellow, or white flesh. These varieties are typically lower in the carotenoid lycopene than red/pink varieties.

A good bit of controversy has arisen over the exact nature of seedless watermelons. Contrary to some information that you will find on various websites, seedless watermelons are not the result of genetic engineering. Seedless watermelons are the result of hybridization. By crossing a diploid watermelon (with two sets of chromosomes) and a tetraploid watermelon (with four sets of chromosomes), it is possible to produce a watermelon that contains triploid seeds (with three chromosomal sets). When planted, these triploid seeds will grow into seedless watermelons. Seedless watermelons will typically appear to contain some white seeds even though they are labeled as seedless. These white seeds are not actually seeds, but only empty seed coats.

Ten years ago, it was somewhat rare to find seedless watermelons in the marketplace. Today, up to 85% of all watermelons produced in the U.S. are estimated to be seedless. This great increase in the availability of seedless watermelons is due to the vastly increased use of "non-bearing pollinators" by watermelon growers. Previously, growers were required to interplant rows of acreage with seeded, fruit-bearing watermelons in order to pollinate their seedless varieties. Today, they are able to pollinate with plants that produce flowers needed by bees, but yield no fruit. These non-fruit-bearing plants allow pollination to continue, but in a less time-consuming and space-consuming way. It's possible to grow seedless watermelons most anywhere that seeded watermelons will grow. Some of the more common seedless varieties include Fandango, Super Cool, Honeyheart, King of Hearts, Queen of Hearts, Crimson Trio, Scarlet Trio, and SuperSweet.

Some common varieties of seeded watermelon include Jubilee, Royal Jubilee, Royal Sweet, Crimson Sweet, Sangria, Fiesta, Sugar Baby, Baby Doll, and Charleston Gray. A 15–20 pound diploid, seeded watermelon will typical contain hundreds of seeds.

History

Watermelons are generally believed to have originated in Africa several thousand years ago and to have traveled over time from Africa to Asia to Europe to North America. Their arrival in Asia and the Middle East is believed to date back to approximately 900–1,000 A.D., and their arrival in Europe is estimated to have occurred in 1300–1400 A.D. It was not until Europeans began to colonize North America that watermelons arrived in what is now the U.S.

Today, over four billion pounds of watermelon are produced each year in the U.S. About 85% of watermelons are purchased in fresh form by consumers. Although there is some watermelon production in virtually all states, about three-fourths of all U.S. watermelons are grown in Florida, California, Texas, Georgia, and Indiana. On an average, per person basis, we eat over 15 pounds of fresh watermelon each year.

On a global basis, China is by far the largest watermelon-producing country and accounts for over half of all world production. The European Union countries, Iran, Turkey, Egypt, Brazil, and the United States are the next largest watermelon producers, but each produces less than 5% of the world total.

How to Select and Store

If you are purchasing a pre-cut watermelon that has already been sliced into halves or quarters, choose the flesh that is deepest in color and lacks any white streaking. If the watermelon is seeded, the seeds should also be deep in color, or white.

When purchasing a whole, uncut watermelon, there are several features to you'll want to evaluate. The first is its weight. A fully ripened watermelon will feel heavy for its size. Heaviness in a watermelon is a good thing because the water content of a watermelon will typically increase along with ripening, and a fully ripened watermelon will be over 90% water in terms of weight, and water is one of the heaviest components in any food

Second, look for a watermelon with a relatively smooth rind that is slightly dulled on top. The top and the bottom of a watermelon are worth determining and examining on a watermelon. The bottom or "underbelly" of a watermelon is the spot where it was resting on the ground. If that "ground spot" is white or green, the watermelon is unlikely to be fully ripe. A fully ripened watermelon will often have a ground spot that has turned creamy yellow in color. Opposite from the ground spot will be the top of the watermelon. In a fully ripened watermelon, that spot will typically not be shiny but somewhat dulled. The green color may appear in many different shades, however, from light green to deeper shades.

Perhaps most controversial about ripeness testing of a watermelon is whether or not to give it a thump. We've read many arguments both pro and con. However, among experts who recommend thumping, most seem to agree that a fully ripened watermelon will have a deeper, hollower "bass" sound rather than a solid and shallow "soprano" sound.

Finally, some grocers will be willing to core an uncut watermelon so that you can have an actual taste. (If you decide not to purchase the melon, the grocer can slice it up and sell it in sliced form.) So consider requesting this if you are uncertain as to the quality.

Uncut watermelons are best stored at temperatures of 50-60°F (10–16°C). In many regions, room temperatures will typically be warmer than 60°F and may be less than ideal for whole watermelon storage due to increased risk of decay. Better storage temperatures will typically be found in cellars or basements that are partly or completely below ground level. While we've seen one study showing increases in lycopene content when whole watermelon was stored at a temperature of 68°F (20°C), we believe that a fully-ripe or close-to-fully-ripe melon will already have outstanding lycopene content and that it would be better for you to err on the safe side in terms of decay risk if you are planning to wait several days before slicing open your watermelon.

Like temperatures above 60°F (16°C), temperatures much below 50°F (10°C) are not recommended for storage of uncut watermelons. This is due to increased risk of chilling-type injury that can decrease shelf life and flavor. (Therefore, the refrigerator would not be a good place for you to store a whole, uncut watermelon for this reason.)

With uncut, whole watermelon, one final storage precaution would be the avoidance of contact with high ethylene-producing foods like passion fruit, apples, peaches, pears, and papaya. Watermelons are ethylene-sensitive fruits that may become overly ripe too quickly under these circumstances.

Once cut, watermelons should be refrigerated in order to best preserve their freshness, taste, and juiciness. Store your cut watermelon in a sealed, hard plastic or glass container with a lid.

How to Enjoy

A Few Quick Serving Ideas

- Purée watermelon, cantaloupe and kiwi together. Swirl in a little plain yogurt and serve as refreshing cold soup.
- In Asian countries, roasted watermelon seeds are either seasoned and eaten as a snack food or ground up into cereal and used to make bread.
- A featured item of Southern American cooking, the rind of watermelon can be marinated, pickled, or candied.
- Watermelon mixed with thinly sliced red onion, salt and black pepper makes a great summer salad.
- Watermelon is a wonderful addition to fruit salad. And fruit salad can be made days ahead since cut fruit, if chilled, retains its nutrients for at least 6 days.

WHFoods Recipes That Feature Watermelon

- Grape and Melon Salad
- 5-Minute Watermelon Frappe

Safety

During the past decade, non-organic watermelons grown in part of China became the topic of widespread controversy in the popular press following the use of a synthetic growth stimulator called forchlorfenuron in their cultivation. A combination of heavy rainfall and potential overuse of the growth stimulator actually caused many watermelons on farms in Jiangsu Province to burst open, drawing media attention to this practice. While we are not aware of any data on widespread use of synthetic growth stimulators in the production of non-organic watermelon, we have seen one study predicting residues of forchlorfenuron in the range of 1-5 ppb in watermelons raised with the use of this synthetic growth stimulator. If you are seeking to lower your risk of contamination with all synthetic additives in watermelon and other foods, we recommend purchase of certified organic watermelon, since synthetic growth stimulators and other synthetic additives are prohibited in organic food production.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Watermelon, diced, fresh **1.00 cup** **152.00 grams**			**Calories: 46** **GI: medium**
	DRI/DV	**Nutrient**	**World's Healthiest**

Nutrient	Amount	(%)	Density	Foods Rating
vitamin C	12.31 mg	16	6.5	very good
pantothenic acid	0.34 mg	7	2.7	good
copper	0.06 mg	7	2.6	good
biotin	1.52 mcg	5	2.0	good
potassium	170.24 mg	5	1.9	good
vitamin A	43.24 mcg RAE	5	1.9	good
vitamin B1	0.05 mg	4	1.6	good
vitamin B6	0.07 mg	4	1.6	good
magnesium	15.20 mg	4	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.

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Cod

The white, mild flavored flesh of cod is available throughout the year and is a wonderful substitute for meat protein with its versatility making it easily adaptable to all methods of cooking.

Cod belong to the same family (*Gadidae*) along with both haddock and pollock. It's not surprising that the words "cod" and "cold" are so similar since cod need the cold, deep, Arctic waters to grow, reproduce and survive.

Cod, Pacific fillet, baked
4.00 oz
(113.40 grams)

Calories: 96
GI: very low

Nutrient	DRI/DV
vitamin B12	109%
iodine	88%
selenium	58%
phosphorus	56%
protein	42%
choline	21%
vitamin B3	10%
molybdenum	9%
vitamin B6	9%
potassium	9%
pantothenic acid	8%
omega-3 fats	8%

Health Benefits

Besides being an excellent low-calorie source of protein (a four-ounce serving of cod contains over 21 grams), cod contains a variety of very important nutrients and has also been shown to be useful in a number of different health conditions.

Cardiovascular Benefits

Fish, particularly cold water fish like cod, have been shown to be very beneficial for people with atherosclerosis and diabetic heart disease. Studies show that people who eat fish regularly have a much lower risk of heart disease and heart attack than people who don't consume fish. Cod, specifically, promotes cardiovascular health because it is a good source of blood-thinning omega-3 fatty acids as well as an excellent source of vitamin B12 and a good source of vitamin B6, both of which are needed to keep *homocysteine* levels low. This is important because homocysteine is a dangerous molecule that is directly damaging to blood vessel walls, and high homocysteine levels are associated with a greatly increased risk of heart attack and stroke(homocysteine is also associated with osteoporosis, and a recent study found that osteoporosis occurred more frequently among women whose vitamin B12 status was deficient or marginal compared with those who had normal B12 status.) Cod is also a very good source of niacin, another B vitamin that is often used to lower high cholesterol levels, something else that can lead to heart disease.

Increases Heart Rate Variability—A Measure of Heart Muscle Function

One of the ways in which consuming fish rich in omega-3 fats, such as salmon, promotes cardiovascular health is by increasing heart rate variability (HRV), a measure of cardiac function, in as little as three weeks, according to a study published in the April 2005 issue of *Chest*.

By providing greater variability between beats, the marine omega 3 fatty acids, EPA and DHA, reduce the risk of arrhythmia and/or sudden death.

Researchers from Atlanta, GA, Boston, MA, and Cuernavaca, Mexico, took the HRV of 58 elderly patients every other day for two months to establish an HRV baseline for each participant. For the next 11 weeks, half of the study participants took a daily 2 gram supplement of fish oil and the other half took a daily 2 gram supplement of soy oil.

Patients in both groups experienced a significant increase in HRV, with those who took fish oil achieving a greater increase in a shorter time period. Patients who received fish oil experienced increased HRV within the first 2.7 weeks, whereas it took 8.1 weeks for a significant increase in HRV to be seen in the group taking soy oil.

On the other hand, while none of the study participants experienced significant negative side effects, 41% of participants in the fish oil group reported belching, compared to 16% in the soy oil group.

"Our findings contradict the current belief in the medical community that increasing the intake of omega-3 fatty acids produces only long-term cardiac benefits," said the study's lead author, Fernando Holguin, MD, Emory University School of Medicine, Atlanta, GA. "In fact, our study group showed improvements in heart function in as little as two weeks."

"Studies like this demonstrate that there are additional approaches we can take to protect ourselves from heart attacks," said Paul A. Kvale, MD, FCCP, President of the American College of Chest Physicians. "It's exciting to see the potential for omega-3 fatty acids in improving heart function when it complements a healthy lifestyle of exercising, maintaining a healthy weight, and getting eight hours of sleep."

We'd add eating healthful foods to this proactive list. Rather than pop a daily pill, we'd rather enjoy a daily "dose" of delicious cod, soyfoods, or tuna. For recipes certain to not only increase your heart rate variability but also your delight in eating, click Recipes.

Protection against Fatal Heart Arrhythmia

A healthy way of eating that includes at least 10 ounces of omega-3-rich fish each week improves the electrical properties of heart cells, protecting against fatal abnormal heart rhythms, suggests a study from Greece.

"Long-term consumption of fish is associated with lower QT interval in free-eating people without any evidence of cardiovascular disease. Thus, fish intake seems to provide anti-arrhythmic protection at a population level," wrote the authors in the American Journal of Clinical Nutrition. (Chrysohoou C, et al.)

The QT interval is a measure of the heart's electrical cycle, from the beginning of ventricular depolarization, the Q wave, to the end of the T wave, at which point cardiac repolarization is complete.

A lower QT score indicates a lower resting heart rate. As a higher resting heart rate has been linked to an increased risk of sudden death, the result of approximately 50% of heart attacks, lowering the resting heart rate provides significant health benefit.

Researchers at the University of Athens enrolled 3,042 people (1,514 men, aged 18-87, and 1,528 women, aged 18-89), who used a validated food frequency questionnaire to record their food intake of 156 different foods. Along with alcohol consumption and physical activity were also recorded, and electrocardiography was used to measure several indexes of study participants' heart rate.

After the raw data scan, those who ate more than 10 ounces (300 grams) of fish per week were found to have QT scores 13.6% lower than people who did not eat fish.

After adjusting the results for potentially confounding factors such as age, sex, physical activity status, BMI, smoking habits and intake of nuts, the reduction in QT scores in those eating 10 or more ounces of fish each week rose to 29.2%, compared to those who did not eat fish.

In an earlier study, Harvard researchers reported that among those consuming the most fish, heart rate was 2.3 beats per minute lower and likelihood of prolonged QT was 46% lower. Similar results were found in study participants taking 1 gram of omega-3s daily. The mechanism behind these benefits is thought to be omega-3 fats' effects on the flow of sodium and calcium in the ion channels, which are involved with electrical signaling in cells.

Practical Tip: A typical serving of fish is 4 ounces, so just 3 servings of omega-3-rich fish, such as cod, each week would provide 2 ounces more than the 10 ounces this research indicates confers significant protection against sudden death from a heart attack. For great, quick and easy recipe ideas, take a look at our Recipe Assistant.

Eating fish, such as cod, as little as 1 to 3 times per month may protect against ischemic stroke (a stroke caused by lack of blood supply to the brain, for example, as a result of a blood clot), suggests a meta-analysis of 8 studies published in the July 2004 issue of *Stroke*.

Data on nine independent groups participating in eight different studies found that, compared to those who never consumed fish or ate fish less than once per month, risk of ischemic stroke dropped:

- 9% in those eating fish 1 to 3 times per month
- 13% in those eating fish once per week
- 18% in those eating fish 2 to 4 times per week
- 31% in those eating fish 5 or more times each week

Just Two Servings of Omega-3-rich Fish a Week Can Lower Triglycerides

Triglycerides are a form in which fat is carried in your bloodstream. In normal amounts, triglycerides are important for good health because they serve as a major source of energy. High levels of triglycerides, however, are associated with high total cholesterol, high LDL (bad) cholesterol and low HDL (good) cholesterol), and therefore, with an increased risk of cardiovascular disease.

In addition, high triglycerides are often found along with a group of other disease risk factors that has been labeled *metabolic syndrome*, a condition known to increase risk of not only heart disease, but diabetes and stroke. (Metabolic syndrome is the combined presence of high triglycerides, increased blood pressure, high blood sugar, excess weight, and low HDL (good) cholesterol.)

Triglyceride Levels	
Less than 150 mg/dL	Normal
150-199 mg/dL	Borderline-high
200-499 mg/dL	High
500 mg/dL	Very High

*Note: Triglycerides are most accurately measured after an 8-12 hour fast.

In this 6-month study involving 142 overweight men and women with high triglycerides, subjects were divided into 5 groups, one of which served as a control group, 2 of which ate 2 servings of fish high in omega-3s while also replacing their normal household fats with fat high in sunflower (Group 1) or canola oil made from rapeseed (Group 2), and 2 of which ate 2 weekly servings of white fish while also replacing their normal household fats with ones high in sunflower (Group 3) or canola oil made from rapeseed (Group 4).

Canola oil also provides some omega-3 fats, with an omega-6:omega-3 ratio of 2:1, while sunflower oil contains omega-6, but no omega-3 fats.

At the end of the study, triglyceride levels had dropped 6.6% in the omega-3-rich fish groups combined. Triglycerides dropped most—10.4%—in those consuming omega-3-rich fish and canola oil. In those eating omega-3-rich fish and sunflower oil, triglycerides dropped 2.8%.

Bottomline: A healthy way of eating that incorporates at least 2 weekly servings of fish and other food sources of omega-3 fats, such as flaxseed or canola oil, may significantly lower triglyceride levels. Replacing normal household fats with flaxseed oil, in which the ratio of omega-6:omega:3 fats is 1:4, might result in an even larger drop in triglyceride levels.

Eating Fish Daily Provides Substantially More Protection against Heart Attack

While as little as a weekly serving of fish lowers risk of ischemic stroke, enjoying a daily serving omega-3-rich fish, such as cod, provides significantly greater reduction in the risk of coronary heart disease than eating fish even as frequently as a couple of times a week, show the findings of a study published in the January 17, 2006 issue of *Circulation*, the journal of the American Heart Association.

Researchers in Japan followed 41,578 men and women aged 40 to 59, none of whom had cardiovascular disease or cancer when the study began, from 1990-1992 to 2001. Food frequency questionnaires completed at the beginning of the study and in 1995, provided information on weekly fish intake, which was analyzed for omega-3 content.

When individuals whose fish consumption was in the top one-fifth of participants at 8 times per week were compared to those whose intake was in the lowest fifth at once per week, they were found to have a 37% lower risk of developing coronary heart disease and a 56% percent lower risk of heart attack.

When the effect of omega-3 fatty acid intake on cardiovascular risk was analyzed, coronary heart disease risk was lowered by 42% among those whose intake was the highest at 2.1 grams per day or more compared to those whose intake was the lowest at 300 milligrams per day. Those whose intake of omega 3s was in the top fifth received a 65% reduction in the risk of heart attack compared to those whose omega 3 intake was lowest.

The authors theorize that daily fish consumption is highly protective largely due to the resulting daily supply of omega-3 fatty acids, which not only reduce platelet aggregation, but also decrease the production of pro-inflammatory compounds called leukotrienes. Lowering leukotrienes reduces damage to the endothelium (the lining of the blood vessels), a key factor in the development of atherosclerosis. "Our results suggest that a high fish intake may add a further beneficial effect for the prevention of coronary heart disease among middle-aged persons," note the study's authors.

Choose Broiled or Baked, but Not Fried Cod

Eating cod that's broiled or baked, but not fried, may reduce risk of atrial fibrillation, the most common type of heart arrhythmia, especially in the elderly, according to a Harvard study published in the July 2004 issue of *Circulation*. In the 12-year study of 4,815 people 65 years of age or older, eating canned tuna or other broiled or baked fish 1 to 4 times a week correlated with increased blood levels of omega-3 fatty acids and a 28% lower risk of atrial fibrillation. Eating broiled or baked fish 5 times a week lowered risk even more—a drop in atrial fibrillation risk of 31%.

Eating fried fish, however, provided no similar protection. Not only is fried fish typically made from lean fish like cod and Pollack that provide fewer omega-3 fatty acids, but in addition, frying results in the production of damaged, free-radical-laden fats in the fish as well as the frying oil.

In further research to determine if the omega-3 fats found in fish oil were responsible for fish's beneficial effects on the heart's electrical circuitry, Dariush Mozaffarian and colleagues from Harvard Medical School analyzed data on fish intake and electrocardiogram results from 5096 adults, aged 65 or older, who were enrolled in the Cardiovascular Health Study from 1989-1990.

Eating tuna or other broiled or baked fish at least once a week was associated with lower heart rate (-3.2 beats/minute) and a 50% lower likelihood of prolonged ventricular repolarisation (the period of time it takes the heart to recharge after it beats, so it can beat again), compared to those consuming fish less than once a month.

Consuming 1 gram/day of omega-3 fatty acids from fish was associated with 2.3 beats/minutes lower heart rate and a 46% lower risk of prolonged ventricular repolarisation.

Eating fish at least 5 times per week was associated with an even healthier heart rhythm.

However, eating fried fish (typically sold in the U.S. as fish burgers or fish sticks) was not associated with increased blood levels of omega 3 fats or any beneficial electrocardiogram results.

In fact, a previous study led by the same researcher (Mozaffarian, *Am J Cardiol* 2006 Jan) found that while eating baked or broiled fish was linked to a slower but more powerful heart beat and lower blood pressure, eating fried fish was associated with heart muscle motion abnormalities, a reduced ejection fraction, lower cardiac output, and higher blood pressure.

Since irregular heart beats are a major precipitating factor in sudden death due to cardiac arrest, promoting a healthy heart rhythm by eating baked or broiled—not fried—fish several times a week makes very good sense. Happily, as our recipes, such Mediterranean Cod show, it's a quick, easy and most importantly, delicious prescription.

Help Prevent and Control High Blood Pressure

Individuals whose diets provide greater amounts of omega-3 fatty polyunsaturated fatty acids—and cod is a good source of these essential fats—have lower blood pressure than those who consume less, shows data gathered in the International Study of Macro- and Micro-nutrients and Blood Pressure (INTERMAP) study (Ueshima H, Stamler J, et al. Hypertension).

The INTERMAP is a study of lifestyle factors, including diet, and their effect on blood pressure in 4,680 men and women aged 40 to 59 living in Japan, China, the U.S. and the U.K. Blood pressure was measured and dietary recall questionnaires were completed by participants on four occasions. Dietary data was analyzed for levels of omega-3 fatty acids from food sources including fish, nuts, seeds and vegetable oils.

Average daily intake of omega-3 fatty acids was 2 grams. Participants with a high (o.67% kcal) omega-3 fatty acid percentage of their daily calorie intake had an average systolic and diastolic blood pressure reading that was 0.55/0.57 mm Hg less, respectively, than participants with lower intake. Previous research has found that a decrease of 2 mm Hg reduces the population-wide average stroke mortality rate by 6 percent and that of coronary heart disease by 4%.

Higher omega-3 fatty acid intake among the 2,238 subjects who were not using drugs, supplements, or a special diet for hypertension, heart disease, or diabetes was associated with a 1.01/0.98 mm Hg reduction in systolic and diastolic blood pressure, respectively.

For the 2,038 subjects in this group who did not have hypertension, greater intake was associated with a 0.91/0.92 mm Hg average systolic and diastolic reduction.

Lead author Hirotsugu Ueshima, MD of Shiga University of Medical Science in Japan, noted that the beneficial effect of omega-3 fats was even greater in people who had not yet developed high blood pressure.

The researchers also found that omega-3s from nuts, seeds, and vegetable oils—such as walnuts and flaxseed—had just as much impact on blood pressure as omega-3s from fish. "With blood pressure, every millimeter counts. The effect of each nutrient is apparently small but independent, so together they can add up to a substantial impact on blood pressure. If you can reduce blood pressure a few millimeters from eating less salt, losing a few pounds, avoiding heavy drinking, eating more vegetables, whole grains and fruits (for their fiber, minerals, vegetable protein and other nutrients) and getting more omega-3 fatty acids, then you've made a big difference," said Ueshima.

Fish, Fruit and Vegetables Protective against Deep Vein Thrombosis, Pulmonary Embolism

Deep vein thrombosis is a dangerous condition in which blood clots develop in the deep veins of the legs, thighs or pelvis, causing swelling and pain. An embolism is created if a part or all of the blood clot in the deep vein breaks off from the site where it was created and moves through the venous system. If the clot lodges in the lung, a very serious condition, pulmonary embolism, arises.

Fortunately, a healthy way of eating offers significant protection, as demonstrated by a prospective study over 12 years that involved almost 15,000 middle-aged adults. While those eating the most red and processed meat doubled their risk of deep vein thrombosis (DVT), those in the upper 3 quintiles of fruit and vegetable intake had a 41-53% lower risk of DVT. And those eating fish, such as cod, at least once each week were found to have a 30-45% lower DVT risk. (Steffen LM, Folsom AR, et al.,*Circulation*)

Practical Tip: For protection against deep vein thrombosis, increase your consumption of fruit and vegetables; eat fish at least once a week; and decrease consumption of red and processed meats.

Protection Against Cancer

Fish consumption is also correlated with a reduced incidence of colon cancer. The selenium and vitamin B12 found in cod have all been shown to reduce the risk of the development of colon cancer by protecting colon cells from the damage caused by toxic substances found in certain foods and cancer-causing chemicals produced by certain gut bacteria.

Omega-3-Rich Fish Protective against Colorectal Cancer

A diet rich in the omega-3 fats found in cold water fish, such as cod, greatly reduces risk of colorectal cancer, indicates a study comparing 1,455 subjects with colorectal cancer to 1,455 matched healthy controls.

Those whose diets provided the most omega-3s had a 37% reduction in colorectal cancer risk, compared to those whose diets provided the least. Colorectal cancer risk was 41% lower in those with the highest average intake of EPA, and 37% lower in those whose diets supplied the most DHA. (Theodoratou E, McNeill G, et al., *Am J Epidemiol.*)

Lower Your Risk of Leukemia, Multiple Myeloma, and Non-Hodgkins Lymphoma

Fishermen have, in epidemiological studies, been identified as having a lower risk of leukemia, multiple myeloma and non-Hodgkin lymphoma, an occupational benefit that researchers thought might be due to the fact that they eat more fish.

Now, a Canadian study published in the April 2004 issue of *Cancer Epidemiology Biomarkers & Prevention* suggests that persons whose diet includes more weekly servings of fresh fatty fish have a much lower risk of these three types of cancer. Data drawn from a survey of the fish eating habits of 6,800 Canadians indicates that those consuming the most fatty fish decreased their risk of leukemia by 28%, their risk of multiple myeloma by 36%, and their risk of non-Hodgkin lymphoma by 29%. Overall, frequent eaters of fatty fish reduced their risk for all forms of lymphomas by 30%.

Cod and Other Fatty Fish Highly Protective against Kidney Cancer

Consumption of fatty fish, such as cod, offers significant protection against renal cell carcinoma, the most common form of kidney cancer, suggests evidence presented in a 15.3-year epidemiological study involving 61,433 women who participated in the Swedish Mammography Cohort Study (Wolk A, Larsson SC, *JAMA*).

Renal cell carcinoma (RCC), the 10th most common form of cancer with a male:female ratio of 5:3, accounts for more than 80% per cent of all kidney cancers. Although an earlier review of prospective cohort studies (MacLean et al, *JAMA*) did not support the hypothesis that fish consumption is protective, the authors of the new *JAMA* study point out that virtually all the other studies on the subject, including MacLean's, did not take into account whether the fish consumed were fatty or lean fish. (Fatty fish contain 20 to 30 times more omega-3 (DHA and EPA) than lean fish, which provide 3-5 times more vitamin D.)

When this distinction was considered, the researchers found that those who consumed one or more serving of fatty fish each week had a 44% decreased risk of RCC compared with those who consumed no fatty fish.

Plus, those who reported long-term consumption between the beginning of the study and the 10-year follow-up had a dramatic 74% lower risk.

In contrast, no association was found between consumption of lean fish or other seafood and incidence of RCC.

Wolk notes,"Our results support the hypothesis that frequent consumption of fatty fish may lower the risk of RCC, possibly due to increased intake of fish oil rich in EPA and DHA, as well as vitamin D."

Protection against Alzheimer's and Age-related Cognitive Decline

Can eating fish high in the omega-3 fatty acids, DHA(docosahexaenoic acid) and EPA (eicosapentaenoic acid), help lessen the cognitive decline and Alzheimer's disease growing in our aging population? A number of studies indicate the answer to this question is a resounding "Yes."

In a paper published in the journal *Neuron* (Calon F, Lim GP, et al.), researchers at the University of California, Los Angeles School of Medicine reported that a diet rich in DHA reduced the impact of a gene linked to the development of Alzheimer's disease.

Using mice bred to have genetic mutations that cause lesions typical of Alzheimer's, the researchers found that those fed a diet containing omega-3-rich fish did not develop the expected memory loss or brain damage. In contrast, mice fed safflower oil, which is low in the omega-3 fats and high in the omega-6 fatty acids, showed signs of synaptic damage in their brains that closely resemble those of people with Alzheimer's.

A report from the Framingham Heart Study published in the *Archives of Neurology* showed that persons whose blood levels of DHA placed them in the top quartile of values had a significantly (47%) lower risk of developing all-cause dementia than did those in the bottom quartile. Plus, greater protection against cognitive decline was obtained from consuming 2.9 than 1.3 fish meals per week. (Schaefer EJ, Bongard V, et al.)

Three additional positive studies have been published in the *American Journal of Clinical Nutrition*:

In the Zutphen Elderly Study, which involved 210 men aged 70-89 years (van Gelder BM, Tijhuis M, et al.), a linear relation was found between the estimated intake of DHA and EPA and prevention of cognitive decline.

A DHA+EPA intake of approximately 380 mg per day seemed to prevent cognitive decline. This amount of DHA+EPA would be found in just 20 grams (just 2/3 of one ounce) of Chinook salmon or in 100 grams (about 3 ounces) of cod.

Eating just two to three meals of fish a week would supply approximately 380 mg EPA+DHA per day.

In the Minneapolis study (Beydoun MA, Kaufman JS et al.) of 2251 men and women, risk of cognitive decline increased as levels of omega-6 (arachidonic acid) increased in subjects' cholesterol and other blood lipids, but decreased as the concentration of omega-3 fat (linoleic acid) increased in their blood fats.

Among subjects with high blood pressure and high cholesterol, cognitive decline was clearly associated with lower blood levels of omega-3 fats (DHA+EPA).

In the Hordaland Health Study, 2,031 adults (55% women) aged 70-74, underwent a battery of cognitive tests including the Kendrick Object Learning Test, Trail Making Test (part A), modified versions of the Digit Symbol Test, Block Design, Mini-Mental State Examination, and the Controlled Oral Word Association Test.

Subjects eating an average of at least 10 grams of fish a day (1 ounce = 30 grams, so eating just 2.1 ounces of fish each week would supply an average of 10 grams daily) had significantly better mean test scores and a lower prevalence of poor cognitive performance than those whose intake averaged less than 10 grams/day.

The associations between total seafood intake and cognition were strongly dose-dependent with maximum benefit observed at an intake of approximately 75 grams/day (this would translate to 2.5 ounces of fish per day or approximately four 4-ounce servings of fish per week). Almost all cognitive functions were beneficially influenced by eating fish, particularly nonprocessed lean fish and fatty fish. (Nurk E, Drevon CA, et al., *Am J Clin Nutr*.)

In all of these studies, fish consumption and the resulting increase in blood levels of omega-3 fatty acids significantly lessened mental decline over time.

How? A number of mechanisms have been suggested in recent studies to explain fish's protective effects against cognitive decline and Alzheimer's:

- EPA's anti-clotting and anti-inflammatory actions promote a healthy blood supply to the brain and lower inflammation.
- Since EPA and arachidonic acid are metabolized by the same enzymes, an increase in levels of EPA helps lessen the production of the pro-inflammatory compounds derived from arachidonic acid. (Arachidonic acid is a precursor of proinflammatory cytokines eicosanoids that are thought to be associated with greater cognitive decline.)
- Increasing consumption of DHA may correct the DHA deficiency in the cerebral cortex characteristically seen in patients with Alzheimer disease.
- DHA is involved in the membrane of ion channels in the brain, making it easier for them to change shape and transmit electrical signals.
- DHA is the source of an anti-inflammatory compound made in the brain called NPD1 that lessens amyloid-beta production in cytokine-stressed human brain cells.
- DHA slows the accumulation of tau, a protein involved in the development of neurofibrillary tangles, and also decreases beta amyloid formation by reducing levels of presenilin, the enzyme that separates beta amyloid from its parent protein. (Neurofibrillary tangles and beta amyloid plaques are the two types of brain lesions seen in Alzheimer's disease.)

Frank LaFerla, co-author of research published in the *Journal of Neuroscience* showing that DHA helps prevent the formation of neurofibrillary tangles and decreases beta amyloid formation, commented: "We are greatly excited by these results, which show us that simple changes in diet can positively alter the way the brain works and lead to protection from Alzheimer's disease pathology." Practical Tip: To keep your cognitive edge, cut back on sources of omega-6 fats, such as beef, and corn, palm, peanut, safflower and sunflower oils, and enjoy omega-3-rich cold water fish, such as cod, at least 3 times each week.

Omega-3 Fat, DHA, Destroys Alzheimer's Plaques

DHA boosts production of the protein LR11, which destroys the beta-amyloid plaques associated with Alzheimer's disease, shows brain cell research.

"Because reduced LR11 is known to increase beta-amyloid production and may be a significant genetic cause of late-onset Alzheimer's disease (LOAD), our results indicate that DHA increases in LR11 levels may play an important role in preventing LOAD," wrote the researchers in the *Journal of Neuroscience*.

"Genetic polymorphisms that reduce LR11 expression are associated with increased AD risk," explained the researchers. "However these polymorphisms account for only a fraction of cases with LR11 deficits, suggesting involvement of environmental factors."

The new research investigated if fish oil and DHA could boost LR11 levels, since having high levels of LR11 have been reported to prevent plaque formation, while low levels in patients are believed to be a factor in causing the disease.

Even low doses of DHA increased the levels of LR11 in rat brain cells. Dietary DHA increased LR11 levels in the brains of rats or older mice genetically engineered to develop Alzheimer's disease. The positive effects of DHA on LR11 levels and the protection against Alzheimer's was again seen human brain cells were used. (Ma QL, Teter B, et al. *J Neurosci.*)

As a result of these findings, the National Institutes of Health has begun a large-scale clinical trial with DHA in patients with well established Alzheimer's disease. Lead researcher, Greg Cole, associate director of UCLA's Alzheimer Disease Research Center, thinks it may be too late for DHA to benefit these patients, but that DHA is highly likely to benefit patients in the earliest stages of Alzheimer's. And, we would add, help prevent the development of the disease in the rest of us!

DHA is the most abundant essential fatty acid in the brain, is crucial for healthy brain development, and low levels have been linked to cognitive impairment. According to the national Alzheimer's Association, approximately 5.1 million Americans suffer from Alzheimer's disease, a number that is projected to increase to 11 to 16 million sufferers by 2050.

Practical Tip: Enjoying several weekly servings of fish high in DHA, such as cod, is a smart move.

Omega-3-Rich Diet Improves Mood, Reduces Depression

When researchers from Ohio State University evaluated blood samples taken from 43 older adults (average age 67), they found that study participants with high ratios of omega-6 to omega-3 not only had higher levels of various compounds involved in inflammation, but were more likely to suffer from depression.

Both depression and stress promote the production of pro-inflammatory cytokines. Researchers measured a number of these pro-inflammatory compounds including tumour necrosis factor-alpha (TNF-alpha), interleukin-6 (IL-6), and the IL-6 soluble receptor (sIL-6r). Symptoms of depression were assessed using the Center for Epidemiological Studies Depression Scale.

Levels of pro-inflammatory cytokines increased progressively as depressive symptoms increased. But when depressive symptoms were combined with high omega-6:omega-3 ratios, levels of proinflammatory cytokines skyrocketed by up to 40% more than normal—far beyond the 18% increase resulting from the presence depressive symptoms alone.

Chronic inflammation has already been linked to heart disease, type 2 diabetes, osteoporosis, cognitive decline and Alzheimer's. Earlier epidemiological (population) studies have also linked higher levels of pro-inflammatory cytokines with depressive symptoms. This new study suggests that a diet that is rich in omega-6 fats but includes few of the foods rich in omega-3 fats—such as the standard American diet—promotes not only inflammation, but depression.

The positive take-away is that increasing consumption of foods rich in omega-3s, while decreasing consumption of omega-6-rich foods, can provide some protection against depression, particularly as depressive symptoms increase.

Omega-3s are found in cold water fish, nuts, such as walnuts, and flaxseeds. Alpha-linolenic acid (ALA), the omega-3 in nuts and seeds, can be converted—albeit inefficiently—in the body to the omega-3s found in fish, eicosapentaenoic acid (EPA) and docosahexaenioc acid (DHA).

EPA improves blood flow and is also suggested to affect hormones and the immune system, both of which have a direct effect on brain function. DHA is active in the membrane of ion channels in the brain, making it easier for them to change shape and transmit electrical signals, and is involved in serotonin metabolism (reduced serotonin production and/or activity is a key factor in depression). Practical Tip: Be of good cheer. Cut back on sources of omega-6 fats, such as beef, and corn, palm, peanut, safflower and sunflower oils. Enjoy a handful of omega-3-rich walnuts and/or flaxseeds daily, and a serving of cold water fish, such as cod, at least 3 times each week.

Reduce Your Risk of Macular Degeneration

A diet high in omega-3 essential fatty acids, especially from fish, offers significant protection against both early and late age-related macular degeneration (AMD), show two studies published in the July 2006 issue of the *Archives of Opthalmology*.

In age-related macular degeneration, the area at the back of the retina called the macula, which controls fine vision, deteriorates, resulting in central vision loss and even blindness. AMD is the leading cause of blindness in people over 50, affecting more than 30 million people worldwide.

In the first study, Brian Chua and colleagues in Sydney, Australia, utilized data from the Blue Mountains Eye Study, which enrolled 3,654 men and women aged 49 and older between 1992 and 1994. Dietary questionnaires completed by 2,895 participants at the beginning of the study provided information on fatty acid intake.

Participants among the top one-fifth in terms of omega-3-rich fish consumption had a 42% lower risk of early AMD compared to those whose fish intake placed them in the lowest fifth. Enjoying omega-3-rich fish at least once a week provided a a 42% reduction in risk for early AMD.

Eating omega-3-rich fish at least three times a week was associated with a 75% reduction in late AMD.

In the second study, Johanna M. Seddon and colleagues at the Massachusetts Eye and Ear Infirmary, Harvard Medical School, Boston, looked at modifiable and protective factors for AMD among elderly male twins enrolled in the National Academy of Sciences—National Research Council World War II Veteran Twin Registry. Of the 681 twins examined, 222 were found to have intermediate or late stage AMD, and 459 twins had no signs of AMD.

Current smokers had a 1.9-fold (almost double) increased risk of AMD. Even past smokers' risk was highly elevated—a 1.7 increase compared to men who never smoked.

Eating more fish, however, greatly reduced AMD risk. Among the men whose fish consumption put them among the top 25% of dietary omega-3 fatty acid intake, risk of AMD was 45% lower compared to those with the lowest fish / omega-3 intake.

Eating fish at least twice a week reduced AMD risk by 36% compared to those who ate less than one serving of fish per week. The authors noted that AMD is highly preventable simply by following a healthy lifestyle: "About a third of the risk of AMD in this twin study cohort could be attributable to cigarette smoking, and about a fifth of the cases were estimated as preventable with higher fish and omega-3 fatty acid dietary intake."

Anti-Inflammatory Nutrients Reduce Asthma, Arthritis and Migraine

The selenium and omega-3 fats concentrated in cod have anti-inflammatory actions that reduce the inflammation that can lead to asthma attacks, rheumatoid arthritis and osteoarthritis, and even migraines. Studies have shown that children who eat fish several times a week are at a much lower risk of developing asthma than children who don't eat fish. The selenium in cod helps prevent asthma attacks by regenerating antioxidants that are used to reduce the free radical damage that can lead to severe attacks. Selenium is indirectly responsible for keeping the body's supply of at least three vitally important antioxidants intact: these are vitamin C, glutathione, and vitamin E. Although the chemistry of these relationships is complicated, it centers around an enzyme (protein molecule in the body that helps "jump start" a chemical reaction) called *glutathione peroxidase*. This enzyme cannot function without selenium.

The essential fatty acids found in cod have also been shown to prevent the progression of osteoarthritis and rheumatoid arthritis. In fact, in societies where fish is eaten regularly, the rate of rheumatoid arthritis is much lower than in areas where fish is not commonly eaten.The anti-inflammatory actions of the omega-3 fats found in cod reduce the inflammation that is central to the symptoms and progression of rheumatiod and osteoarthritis, and may also help prevent migraine attacks, which are triggered by an inflammatory cascade that spreads from neuron to neuron in the brain called *spreading depression*. A four-ounce serving of cod provides 13% of the daily value for these beneficial omega-3 fats.

Fish and Whole Grains Highly Protective against Childhood Asthma

According to the American Lung Association, almost 20 million Americans suffer from asthma, which is reported to be responsible for over 14 million lost school days in children, and an annual economic cost of more than $16.1 billion.

Increasing consumption of whole grains and fish could reduce the risk of childhood asthma by about 50%, suggests the International Study on Allergy and Asthma in Childhood (Tabak C, Wijga AH, *Thorax*).

The researchers, from the Dutch National Institute of Public Health and the Environment, Utrecht University, University Medical Center Groningen, used food frequency questionnaires completed by the parents of 598 Dutch children aged 8-13 years. They assessed the children's consumption of a range of foods including fish, fruits, vegetables, dairy and whole grain products. Data on asthma and wheezing were also assessed using medical tests as well as questionnaires.

While no association between asthma and intake of fruits, vegetables, and dairy products was found (a result at odds with other studies that have supported a link between antioxidant intake, particularly vitamins C and E, and asthma), the children's intake of both whole grains and fish was significantly linked to incidence of wheezing and current asthma.

In children with a low intake of fish and whole grains, the prevalence of wheezing was almost 20%, but was only 4.2% in children with a high intake of both foods. Low intake of fish and whole grains also correlated with a much higher incidence of current asthma (16.7%). compared to only a 2.8% incidence of current asthma among children with a high intake of both foods.

After adjusting results for possible confounding factors, such as the educational level of the mother, and total energy intake, high intakes of whole grains and fish were found to be associated with a 54 and 66% reduction in the probability of being asthmatic, respectively.

The probability of having asthma with bronchial hyperresponsiveness (BHR), defined as having an increased sensitivity to factors that cause narrowing of the airways, was reduced by 72 and 88% when children had a high-intake of whole grains and fish, respectively. Lead researcher, CoraTabak commented, "The rise in the prevalence of asthma in western societies may be related to changed dietary habits." We agree. The Standard American Diet is sorely deficient in the numerous anti-inflammatory compounds found in fish and whole grains, notably, the omega-3 fats supplied by cold water fish and the magnesium and vitamin E provided by whole grains. One caution: wheat may need to be avoided as it is a common food allergen associated with asthma.

Protection against Sunburn

Another benefit of omega-3s anti-inflammatory effects may be their ability to protect our skin against sunburn, and possibly, skin cancer.

Although our increased susceptibility to skin cancer is usually blamed on damage to the ozone layer, dietary changes over the last 75 years, which have resulted in excessive consumption of omega-6 fatty acids and insufficient consumption of omega-3 fats, may also be causing human skin to be more vulnerable to damage from sunlight.

Research by Dr Lesley Rhodes, Director of the Photobiology Unit at the University of Manchester, UK, suggests that eating more omega-3-rich fish, such as cod, could lessen the inflammation induced by UV-B radiation and help prevent not only the damaging effects of sunburn, but possibly skin cancer as well.

In a paper published in January 2005 in the *Journal of Investigative Dermatology*, Rhodes explored the ability of omega-3s to protect epidermal and dermal skin cells against UV-B-induced triggering of tumor necrosis factor-alpha, a molecule that induces the production of the pro-inflammatory cytokine, IL-8. Both EPA and DHA significantly suppressed TNF-alpha-induced IL-8 secretion—by 54% in the case of EPA and 42% by DHA. In an earlier one of Dr Rhodes studies, published in the May 2003 issue of *Carcinogenesis*, 42 healthy volunteers were given a measured dose of ultraviolet light, then divided into two groups. One group was given a daily 4 gram omega-3 fish oil supplement, while the other group received olive oil. After three months, when their responses to ultraviolet light were again measured, the skin cells of volunteers receiving fish oil experienced significantly less DNA damage, leading Rhodes to suggest that increasing consumption of omega-3-rich fish might reduce skin cancer in humans.

Description

It's not surprising that the words "cod" and "cold" are so similar, just differing by one letter. It's not surprising since cod need the cold. They need to live in deep, artic temperature water to grow, reproduce and survive.

Although there are a few varieties of cod that are generally consumed, North Atlantic cod (*Gadus morhua*) is the most reputed and well known type. It has a light color and a noble taste. Other types of cod that are eaten throughout the world include ling cod, saithe cod and zarbo cod.

Cod belong to the same family (*Gadidae*) as both haddock and monkfish.

History

People have been enjoying cod as a food ever since this beautiful fish appeared in the Earth's waters, basically since time immemorial.

Like other fish, in addition to being consumed fresh, preservation techniques such as salting, smoking and drying were used to preserve the cod. This allowed it to be easily transported and stored and made it one of the most commercially important fishes during the Middle Ages in Europe. Salted and dried cod is still very popular today in many countries including Norway, Portugal and Brazil.

Ever wonder where Cape Cod, Massachusetts, got its name? The answer: from this fish that used to be abundant in the coastal waters of this seaside town as well as the eastern seaboard of the United States and Canada. Unfortunately, over-fishing during the past few decades has greatly diminished the amount of cod in these waters. In addition to North America, much of the cod available in today's market comes from Norway, Greenland, and Iceland.

How to Select and Store

Just as with any seafood, it is best to purchase cod from a store that has a good reputation for having a fresh supply of fish. Get to know a fishmonger (person who sells the fish) at the store, so you can have a trusted source from whom you can purchase your fish.

Fresh whole cod should be displayed buried in ice, while fillets should be placed on top of the ice. The flesh of the cod fillets should gleam and have minimal gaping.

Smell is a good indicator of freshness. Since a slightly "off" smell cannot be detected through plastic, if you have the option, purchase displayed fish as opposed to pieces that are prepackaged. Once the fishmonger wraps and hands you the fish that you have selected, smell it through the paper wrapping and return it if it does not smell right.

When storing all types of seafood, including cod, it is important to keep it cold since fish is very sensitive to temperature. Therefore, after purchasing cod or other fish make sure to return it to a refrigerator as soon as possible. If the fish is going to accompany you during a day full of errands, keep a cooler in the car where you can place the cod to make sure it stays cold and does not spoil.

The temperature of most refrigerators is slightly warmer than ideal for storing fish. Therefore, to ensure maximum freshness and quality, it is important to use special storage methods to create the optimal temperature for holding the fish. One of the easiest ways to do this is to place cod, which has been well wrapped, in a baking dish filled with ice. The baking dish and fish should then be placed on the bottom shelf of the refrigerator, which is its coolest area. Replenish ice one or two times per day.

The length of time that cod can stay fresh stored this way depends upon how fresh it is, i.e. when it was caught. Fish that was caught the day before you purchased it can be stored for about four days, while fish that was caught the week before can only be stored for about one or two days.

How to Enjoy

A Few Quick Serving Ideas

- Combine cod, broth, healthy sautéed onions and garlic, and your favorite vegetables and seasonings in a stock pot to make a delicious fish soup.
- Cod braised with tomatoes, olives, garlic, and Italian herbs is delicious.
- Poaching cod is easy. Just cover it with water or broth, add a little lemon juice, parsley, and simmer until the flesh becomes opaque and flakey.
- Serve steamed cod in a large shallow bowl over a thin layer of miso soup. Garnish with chopped scallions, daikon and shiitake mushrooms.
- Bake cod in the oven covered with fresh chopped herbs, such as chives, tarragon, chervil, and a little fresh lemon juice and broth.

For some of our favorite recipes, click Recipes.

Safety

For information on the topic of seafood and mercury contamination, please see our article "Should I be concerned about mercury in fish and what fish are safe to eat?"

Cod and Food Allergies

Fish, such as cod, are among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Cod, Pacific fillet, baked
4.00 oz
113.40 grams

Calories: 96
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin B12	2.62 mcg	109	20.4	excellent
iodine	132.00 mcg	88	16.4	excellent
selenium	31.75 mcg	58	10.8	excellent
phosphorus	391.22 mg	56	10.4	excellent
protein	21.24 g	42	7.9	excellent
choline	90.38 mg	21	4.0	very good
vitamin B3	1.52 mg	10	1.8	good
potassium	327.72 mg	9	1.7	good
vitamin B6	0.15 mg	9	1.6	good
molybdenum	3.86 mcg	9	1.6	good
pantothenic acid	0.41 mg	8	1.5	good
omega-3 fats	0.19 g	8	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Salmon

What's New and Beneficial about Salmon

- With so much focus on the amazing omega-3 benefits of salmon, other unique health benefits from salmon may have been inadvertently overlooked. One fascinating new area of health benefits involves the protein and amino acid content of salmon. Several recent studies have found that salmon contains small bioactive protein molecules (called bioactive peptides) that may provide special support for joint cartilage, insulin effectiveness, and control of inflammation in the digestive tract. One particular bioactive peptide called calcitonin (sCT) has been of special interest in these studies. The reason is because a human form of calcitonin is made by the thyroid gland, and we know that it is a key hormone for helping regulate and stabilize the balance of collagen and minerals in the bone and surrounding tissue. As researchers learn more and more about salmon peptides—including sCT—we expect to see more and more potential health benefits discovered related to inflammation, including inflammation of the joints.
- Even though contamination with mercury, pesticides, and persistent organic pollutants (POPS) has become a widespread problem in salmon habitats and with the quality of salmon itself, there are still salmon runs that pose relatively low risk in terms of contaminants. Leading this low-risk category for wild-caught salmon are Alaskan salmon. Southeast Alaskan chum, sockeye, coho, pink, and chinook salmon, together with Kodiak coho, pink, and chum salmon have all been evaluated for contaminant consumption risk involving many POPs (including dioxins, dioxin-like compounds, or DLCs, and polychlorinated biphenyls, or PCBs) and have been found to be the lowest risk category of wild-caught salmon for regular consumption. This lower contamination risk amongst all wild-caught salmon is one of the reasons we recommend selection of wild-caught Alaskan salmon as a salmon of choice. (While some salmon runs from British Columbia and the U.S. West Coast also stand out as lower risk in terms of contaminants, we do not feel enthusiastic about recommending them for consumption due to the more precarious sustainability of these salmon runs.)
- Along with lower risk of contamination from wild-caught Alaskan salmon, we like what experts are saying about the greater sustainability of Alaskan salmon runs. For example, the Monterey Bay Aquarium in Monterey, California has recently determined Alaskan salmon to be the only low-risk salmon in terms of four sustainability criteria: the inherent vulnerability of the fish, the effects of fishing on the overall habitat, the status of wild stocks, and the nature of the by-catch (the other types of fish that are caught unintentionally during salmon fishing).
- Like other seafood, salmon is still not covered under regulations issued by the U.S. National Organics Program (NOP). However, the National Organics Standards Board has officially adopted recommendations for seafood (including salmon) and government officials at the U.S. Department of Agriculture have plans to implement these new regulations by adding them to the National List and issuing rules for compliance. Recommendations from the NOSB currently include:

    - organic certification of farmed salmon that meet certain standards
    - no certification of any wild-caught salmon
    - allowance of up to 25% fish oil and fish meal from wild-caught fish in the feeding of farmed organic salmon
    - permitted use of net pens and inland containment facilities

  All aspects of the NOSB recommendations remain controversial. The limitation of organic certification to farmed salmon appears to have been related to the NOSB's desire for certainty about compliance of salmon production with organic regulations as well as its belief that verification of compliance for wild-caught salmon would simply not be possible. However, many advocates of sustainable food argue that farming creates an unnatural habitat for fish and is likely to compromise fish quality. Since organic regulations prohibit the use of animal by-products in the feeding of land animals (like cows or chickens), this area of certification for farmed fish has been equally controversial. When salmon migrate out to sea, many different types of fish are included in their natural diet. From this perspective, it would seem appropriate to allow the feeding of fish oil and fish meal from wild-caught fish to farmed organic salmon. However, at the same time, prohibited feeding of non-organic animal by-products to cows, chickens, and other land animals has played an important role in assuring organic quality. When animals are being raised for organic food, it's obvious that non-organic animal by-products in their diet increase risk of contamination.

  While we welcome the idea of certification standards for organic seafood, we aren't convinced that the current NOSB recommendations make good sense. For this reason, if the current recommendations are implemented into law, we will continue to recommend selection of wild-caught Alaskan salmon as a salmon of choice, even over certified organic, farm-raised salmon. However, if changes are made in the current NOSB recommendations, we'll re-evaluate your best chances of getting optimal nourishment from any salmon that you decide to include in your meal plan.

Salmon, wild Coho, broiled
4.00 oz
(113.40 grams)

Calories: 158
GI: very low

Nutrient	DRI/DV
vitamin B12	236%
vitamin D	128%
selenium	78%
vitamin B3	56%
omega-3 fats	55%
protein	53%
phosphorus	52%
vitamin B6	38%
iodine	21%
choline	19%
pantothenic acid	18%
biotin	15%
potassium	14%

Health Benefits

BENEFITS RELATED TO OMEGA-3 CONTENT

Salmon has earned its research reputation as a health-supportive food based largely on its unusual omega-3 fatty acid content. It's very common for 4 ounces of baked or broiled salmon to contain at least 2 grams of omega-3 fats—more than the average U.S. adult gets from all food over the course of several days. (If we consider 4 grams of omega-3 fatty acids to be a daily goal for a person consuming a 2,000 calorie diet—based upon recommendations from the 1999 Workshop on the Essentiality of and Recommended Dietary Intakes (RDI) for Omega-6 and Omega-3 Fatty Acids sponsored by the National Institutes of Health (NIH)—then this would equal about 50% of this goal. For more on this, see our write-up on omega-3s.)

About half of this omega-3 fat is provided in the form of EPA (eicosapentaenoic acid) and a slightly lower amount is provided in the form of DHA (docosahexaenoic acid). The amounts of EPA and DHA contained in salmon are unusual among commonly-eaten foods. In addition to this high concentration of omega-3 fats is the relatively small amount of omega-6 fats in salmon and its outstanding ratio of omega-3 to omega-6. Four ounces of salmon will typically contain less than 1/2 gram of omega-6 fat, for an omega-3 to omega-6 ratio of approximately 5.5 to 1. In the average U.S. diet, this ratio has repeatedly been shown to be lop-sided in the opposite direction, with at least 4-5 times as much omega-6 fat as omega-3 fat, and in some studies, up to 12-20 times more. In our World's Healthiest Foods rating system for food, only two foods provide more omega-3s per standard serving than salmon. Those two foods are walnuts and flaxseeds. Both of these plant foods are outstanding sources of omega-3s! However, they cannot be compared on an equal basis to salmon because their omega-3 fats come in the form of alpha-linolenic acid (ALA) rather than EPA or DHA.

The widely-studied benefits of omega-3 fatty acids are documented in our Omega-3 Fatty Acids profile in the Essential Nutrients section of our website. In general, these benefits involve improved control of the body's inflammatory processes, better overall cell function, improved transfer of information between the body's cells, and better brain function. When researchers look specifically at intake of omega-3-containing fish like salmon, they find health support in all of the above areas. However, some areas of omega-3 support are what we would call "standout" areas. These areas include:

Cardiovascular Benefits

Intake of fish rich in omega-3 fat (including salmon) is associated with decreased risk of numerous cardiovascular problems, including: heart attack, stroke, heart arrhythmia, high blood pressure, and high triglycerides in the blood. Intake of omega-3-containing fish is also associated with improved metabolic markers for cardiovascular disease. Some cardiovascular benefits from omega-3 fat in fish like salmon start with only one omega-3 fish meal per week. Most of the benefits, however, start to show up in research studies with somewhat higher fish intake, along the lines of 2-3 times per week. In most studies, one serving of fish is approximately 6 ounces. Studies of fish intake and cardiovascular risk sometimes measure benefits against total grams of omega-3 fats obtained in the daily diet. In many of these studies, a daily minimum of 2 grams of omega-3s is required for measurable cardiovascular protection. (Remember that this 2-gram amount is the amount contained in approximately 4 ounces of cooked salmon.)

Improved Mood and Cognition

Many researchers consider DHA to be the most important fat found in the human brain, and the unusual concentration of this omega-3 fatty acid in salmon helps explain the research-documented benefits of salmon and omega-3 fish intake for thinking and the decreased risk of certain brain-related problems that accompanies omega-3 fish consumption. Intake of omega-3s and omega-3 containing fish is associated with decreased risk of depression, decreased risk of hostility in some studies of teenagers, and decreased risk of cognitive decline in older persons. Some studies have shown an association between IQ and omega-3 intake, and also between IQ and intake of omega-3 fish.

Especially interesting in this area of fish intake, DHA, and brain function is the relatively recent discovery of protectins. Protectins are special compounds made from DHA and preliminary research studies have shown them to have a potentially important role as anti-inflammatory regulatory molecules, especially when produced by nerve tissue. (When protectins are produced by nerve tissue, they are typically called "neuroprotectins.") Researchers have speculated that at least some of the brain-related benefits from omega-3 fish intake may be due to conversion of the DHA in these fish to protectins that can help prevent excessive inflammation.

Joint Protection

One fascinating area of omega-3 and omega-3 fish research has involved the joints. Research on fish intake and joint protection has shown that EPA from fish like salmon can be converted by the body into three types of closely-related compounds that work to prevent unwanted inflammation. One group of compounds are the series 3 prostaglandins. A second type are the series 3 thromboxanes. A third and more recently discovered type are the resolvins. All of these omega-3 fat derivatives are able to help prevent excessive and unwanted inflammation. What's especially interesting about salmon, however, is that it combines these anti-inflammatory benefits that are related to omega-3 content with anti-inflammatory benefits that are related not to fat but to protein. Recent studies demonstrate the presence of small bioactive protein molecules (called bioactive peptides) in salmon that may provide special support for joint cartilage (as well as other types of tissue). One particular bioactive peptide called calcitonin has been of special interest in these studies, because a human form of calcitonin is made in the human body by the thyroid gland, and we know that it is a key hormone for helping regulate and stabilize the balance of collagen and minerals in the bone and surrounding tissue. Salmon peptides—including calcitonin (sCT)—may join forces with salmon's omega-3 molecules to provide unique anti-inflammatory benefits for the joints

Eye Benefits

Omega-3 intake and consumption of omega-3 fish has been associated with decreased risk of two eye-related problems: macular degeneration and chronic dry eye. In the case of macular degeneration (a chronic eye problem in which material in the center of the retina on the back of the eyeball begins to deteriorate and cause loss of vision), two fish servings per week is the amount that has been shown to significantly decrease risk. For decreased risk of chronic dry eye, a somewhat higher amount of omega-3 fish intake (2-4 servings per week) was the minimum amount needed, with 5-6 weekly servings showing even greater reduction of risk.

Like brain studies on omega-3 fish intake, dry eye studies have started to look specifically at neuroprotectins made from DHA in salmon and other omega-3 fish. These omega-3 derived molecules may help prevent chronic dry eye by lowering background levels of inflammation in the eye.

Decreased Cancer Risk

Intake of fish rich in omega-3 fat is also associated with decreased risk for several types of cancer. These cancer types include colorectal cancer, prostate cancer, and breast cancer. Some of the strongest findings for decreased cancer risk following regular intake of omega-3 fish involve the blood cell or lymph cell-related cancers including leukemia, multiple myeloma, and non-Hodgkins lymphoma. Similar to cardiovascular studies, cancer risk studies typically begin to show measurable benefits when omega-3 fish are consumed at least once per week.

Benefits Related to Protein and Amino Acid Content

The outstanding omega-3 benefits of salmon are not this food's only claim to unique health support. One intriguing new area of health benefits for salmon involves the protein and amino acid content of this fish. Several recent studies have found that salmon contains small bioactive protein molecules (called bioactive peptides) that may provide special support for joint cartilage, insulin effectiveness, and control of inflammation in the digestive tract. We've seen recent studies, for example, on salmon peptides and treatment of ulcerative colitis. We also have to wonder whether intake of salmon peptides may be related to the reduced risk of colorectal cancer that is associated with consumption of this food. One particular bioactive peptide called calcitonin has been of special interest in these salmon and amino acid studies. The human body makes its own human form of calcitonin (through a process which takes place in the thyroid gland), and we know that calcitonin is a key hormone for helping regulate and stabilize the balance of collagen and minerals in the bone and surrounding tissue. As researchers learn more and more about salmon peptides—including calcitonin (sCT), and its relationship to human calcitonin—we expect to see more and more of salmon's potential.

Benefits Related to Selenium

Another nutrient concentrated in salmon worthy of special mention is selenium. In terms of absolute selenium amount, salmon ranks in our WHFoods top 10, and four ounces provide about 62% of the Daily Value (DV) for this mineral. Strong selenium intake is associated with decreased risk of joint inflammation, and also with prevention of certain types of cancer, including colorectal cancer. As an antioxidant nutrient, selenium has also been shown to be especially important in cardiovascular protection through maintenance of the molecule glutathione. Each of these selenium-related benefits overlaps with other spotlight areas for salmon as a health-supportive food.

Description

With exceptional nutritional value due to their rich concentration of omega-3 fatty acids, salmon is a favorite among fish lovers and enjoyed even by those who are not always fond of fish. Salmon are incredible fish sometimes traveling thousands of miles throughout their life cycle and within two to five years returning to the very location where they were born to spawn and die. The specific characteristics and life cycles of salmon vary with each species. (For example, king salmon has a life cycle of approximately 4-6 years, sockeye, 4-6 years, and silver 3-4 years.)

A good portion of salmon can be classified either as Pacific (*Oncorhynchus* genus) or Atlantic (*Salmo* genus) salmon, according to the ocean in which they are found. There is just one native species of Atlantic salmon (*Salmo salar*), while there are many species of Pacific salmon including chinook (or king), sockeye (or red), coho (or silver), pink, and chum. Norwegian salmon, a popular type of salmon often offered on restaurant menus, is actually Atlantic salmon that is farm-raised in Norway. The flesh of salmon ranges in color from pink to red to orange with some varieties richer in important omega-3 fatty acids than others. For example, chinook and sockeye are fattier fish than pink and chum and contain great amounts of healthy omega-3 fatty acids.

The native habitats of Atlantic and Pacific salmon as described above no longer characterize most of salmon consumed in the United States or in many other countries. Because farmed salmon now accounts for about 80% of all salmon consumed worldwide, it is becoming harder and harder to find wild-caught salmon that live in their native habitat.

History

People have been enjoying salmon as a food ever since this beautiful fish appeared in the Earth's waters. Like other fish, in addition to being consumed in fresh form, preservation techniques such as smoking or salting were used to preserve the salmon. Smoked salmon is still considered traditional fare in many cuisines throughout the world.

Since 1980, global salmon production has increased over 400% in volume, with over 2,400,000 metric tons of salmon being produced in 2004 compared with less than 600,000 metric tons in 1980. Most of this increase has come from production of farmed salmon. (The amount of farmed salmon in today's marketplace is more than 1,000,000 metric tons greater than it was in 1980.) Farmed salmon now accounts for more than 80% of the world's salmon supply. Within this changing salmon marketplace, North American wild salmon, which used to account for about half of the world's wild salmon supply, now only accounts for about 15%. The farming of salmon has increased dramatically in Europe, and Japan and Russia each currently farm about 500,000 tons of salmon.

The trend toward greatly increased salmon farming has been an ongoing concern to many researchers who study the ecological impact of farmed salmon, including the impact on wild salmon populations. Salmon farming has also concerned many researchers from a health standpoint. Farmed salmon—when raised in a non-sustainable way and without regard for the organic standards that exist in some countries outside the U.S.—have repeatedly been found to have measurable and undesirable amounts of numerous contaminants. Some researchers have raised the question of whether sustainable salmon farming is even possible, given the natural habits of salmon and the unique habitats that have historically supported their vitality.

How to Select and Store

Salmon is sold in many different forms. Fresh salmon is available whole or in steak or fillet form. Salmon is also available frozen, canned, dried or smoked. Based on a combination of sustainability and potential contamination concerns, we recommend that you select wild-caught Alaskan salmon above all other forms of salmon currently available in the marketplace. If you cannot find wild-caught Alaskan salmon in your local grocery in fresh or frozen form, we recommend that you select wild-caught Alaskan salmon in canned form as a next best alternative.

With respect to potential contamination, we base our Alaskan salmon recommendation on recent research placing these salmon at the top of the low-risk list for potential contaminants, including pesticides, and persistent organic pollutants (POPS). Southeast Alaskan chum, sockeye, coho, pink, and chinook salmon, together with Kodiak coho, pink and chum salmon have all been evaluated for contaminant consumption risk involving many POPs (including dioxins, dioxin-like compounds (DLCs) and polychlorinated biphenyls, or PCBs) and have been found to be the lowest risk category of wild-caught salmon for regular consumption.

With respect to sustainability, we have been impressed with the work of the Monterey Bay Aquarium in Monterey, California and its establishment of Alaskan salmon as the only low-risk salmon in terms of four sustainability criteria: the inherent vulnerability of the fish, the effects of fishing on the overall habitat, the status of wild stocks, and the nature of the by-catch (fish other than salmon that are caught unintentionally during salmon fishing). There is one exception to this higher sustainability profile of Alaskan salmon, however, and that exception involves the by-catch related to wild-caught Alaskan chinook. With respect to by-catch, the Monterey Bay Aquarium has placed Alaskan chinook salmon in a moderate versus low-risk category in terms of sustainability. For this reason, you may want to choose other species of Alaskan salmon (like chum or coho or sockeye or pink) for the lowest sustainability risk.

Sustainability issues related to the selection of non-Alaskan salmon have become more and more apparent, especially with respect to U.S. West Coast salmon. In 2008 and for the first time in its history, the National Marine Fisheries Service shut down the U.S. West Coast ocean salmon fishing season due to the large drop in numbers of chinook salmon that were returning to the Sacramento River in California. Whereas 775,000 salmon had returned to this river to spawn in 2002, by 2008 the number of salmon expected to return had dropped dramatically. The Fisheries Service had set a target spawning goal of 122,000-180,000 for the Sacramento River chinook. However, at the time when the fishing season was shut down in 2008, only 54,000 had actually returned. Scientists believe that the loss of natural habitat in the San Francisco Delta is playing a role in the jeopardized sustainability of the Sacramento River chinook salmon run and point to a need for habitat restoration in this context.

Just as with any seafood, it is best to purchase salmon from a store that has a good reputation for having a fresh supply of fish. Get to know a fishmonger (person who sells the fish) at your grocery store, so you can have a trusted resource from whom you can purchase your fish.

Fresh whole salmon should be displayed buried in ice, while fillets and steaks should be placed on top of the ice. If you are purchasing a whole fish and want to eat the skin, have the salmon scaled.

Smell is a good indicator of freshness. Since a slightly "off" smell cannot be detected through plastic, if you have the option, purchase displayed fish as opposed to pieces that are prepackaged. Once the fishmonger wraps and hands you the fish that you have selected, smell it through the paper wrapping and return it if it does not smell right.

While smoked salmon is popular, we don't believe it to be as healthful as fresh or canned salmon. That's because in addition to having less omega-3s than non-smoked fish, smoked fish may contain toxic substances called polycyclic aromatic hydrocarbons (PAHs). For more on this subject, please see this Q+A.

When storing all types of seafood, including salmon, it is important to keep it cold since fish is very sensitive to temperature. Therefore, after purchasing salmon or other fish, make sure to return it to a refrigerator as soon as possible. If the fish is going to accompany you during a day full of errands, keep a cooler in the car where you can place the salmon to make sure it stays cold and does not spoil.

The temperature of most refrigerators is slightly warmer than ideal for storing fish. Therefore, to ensure maximum freshness and quality, it is important to use special storage methods to create the optimal temperature for holding the fish. One of the easiest ways to do this is to place salmon, which has been well wrapped, in a baking dish filled with ice. The baking dish and fish should then be placed on the bottom shelf of the refrigerator, which is its coolest area. Replenish ice one or two times per day.

The length of time that salmon can stay fresh stored this way depends upon how fresh it is, i.e. when it was caught. Fish that was caught the day before you purchased it can be stored for about four days, while fish that was caught the week before can only be stored for about one or two days.

You can extend the shelf life of salmon by freezing it. To do so, wrap it well in plastic and place it in the coldest part of the freezer where it will keep for about two to three weeks.

How to Enjoy

A Few Quick Serving Ideas

- Combine left-over cold salmon with greens and vegetables for a delicious salad.
- Serve seared, or broiled salmon over whole wheat pasta. Top with a sauce made with olive oil, dill weed, lemon peel, scallions and black pepper. Look for our healthy methods of Stovetop Searing and Quick Broiling.
- Quick Broil salmon and top with a honey mustard sauce.

WHFoods Recipes That Feature Salmon

- Salmon, Cucumber, Dill Salad
- 15-Minute Braised Fennel Salmon
- 15-Minute Salmon with Mint Salsa
- Steamed Salmon and Asparagus with Mustard Dill Sauce
- 15-Minute Salmon with Tomato Salsa
- Braised Salmon with Leeks
- Quick Broiled Salmon with Ginger Mint Salsa
- Salmon in Citrus Sauce
- Salmon with Cucumber Chili Salad
- Salmon with Dill Sauce
- Salmon with Mustard
- Salmon with Mustard and Ginger
- Southwestern Salmon & Black Beans

Safety

Since 1946, the U.S. Department of Commerce, through its National Ocean and Atmospheric Administration (NOAA), operates the National Marine Fisheries Service and its Seafood Inspection Program (SIP). In addition, under the Seafood Hazard Analysis and Critical Control Point (HACCP) Regulation, the U.S. Food and Drug Administration is charged with the responsible of inspecting fish processing facilities in the U.S. However, since participation in SIP is voluntary, many fish are brought into the U.S. from other countries, and the HACCP fish processing inspection service only has the funding and manpower to inspect approximately 1% of fish products imported into the U.S., many consumers have become concerned about the safety of their fish, including their salmon. Given widespread contamination of marine habitats worldwide, this concern makes sense to us. We encourage consumers of fish to take special care in choosing all fish, including salmon. "Special care" might mean asking more questions to a local fish purveyor or taking extra time to locate high-quality fish like wild-caught Alaskan salmon. Some fish are not considered safe for pregnant or nursing mothers or young children to eat. Updated information in this area can be found at the U.S. Food and Drug Administration (FDA) website (http://www.fda.gov/food/foodsafety/). For information on the topic of seafood and mercury contamination, please see our article Should I be concerned about mercury in fish and what fish are safe to eat?

For some individuals, a second area of concern related to salmon is genetic engineering. In 2010, the U.S. Food and Drug Administration (FDA) held hearings on the proposed entry of genetically engineered Atlantic farmed salmon into the U.S. marketplace. Propriety, genetically-engineered salmon (proposed for sale under the commercial name AquAdvantage) have been developed using "antifreeze" genes from ocean eelpout (a type of fish) and growth hormone genes from chinook salmon to produce a type of salmon which can grow more quickly and will require less feed for its growth. In a period of several months, the FDA received nearly 400,000 public comments on the proposed allowance of GE salmon into the marketplace. In California, several state legislators have called for mandatory labeling of GE salmon sold in California if the sale of GE salmon is approved by the FDA and the FDA does not require labeling at a federal level. If the sale of GE salmon is allowed by the FDA, individuals wishing to avoid GE salmon intake will need to avoid any farmed salmon products not providing a GE-free label.

Salmon and Food Allergies

Fish, such as salmon, are among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Salmon, wild Coho, broiled
4.00 oz
113.40 grams

Calories: 158
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin B12	5.67 mcg	236	27.0	excellent
vitamin D	511.43 IU	128	14.6	excellent
selenium	43.09 mcg	78	8.9	excellent
vitamin B3	9.02 mg	56	6.4	very good
omega-3 fats	1.32 g	55	6.3	very good
protein	26.59 g	53	6.1	very good
phosphorus	365.14 mg	52	6.0	very good
vitamin B6	0.64 mg	38	4.3	very good
iodine	32.00 mcg	21	2.4	good
choline	81.65 mg	19	2.2	good
pantothenic acid	0.92 mg	18	2.1	good
biotin	4.54 mcg	15	1.7	good
potassium	492.15 mg	14	1.6	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Sardines

Sardines, Atlantic, canned
3.20 oz
(90.72 grams)

Calories: 189
GI: very low

Nutrient	DRI/DV
vitamin B12	338%
selenium	87%
phosphorus	64%
omega-3 fats	61%
protein	45%
vitamin D	44%
calcium	35%
vitamin B3	30%
iodine	24%
copper	19%
choline	16%
vitamin B2	16%

Health Benefits

Promote Heart Health

Sardines are rich in numerous nutrients that have been found to support cardiovascular health. They are one of the most concentrated sources of the omega-3 fatty acids EPA and DHA, which have been found to lower triglycerides and cholesterol levels; one serving (3.25 ounce can) of sardines actually contains over 50% of the daily value for these important nutrients. Sardines are an excellent source of vitamin B12, ranking as one of the World's Healthiest Food most concentrated in this nutrient. Vitamin B12 promotes cardiovascular well-being since it is intricately tied to keeping levels of homocysteine in balance; homocysteine can damage artery walls, with elevated levels being a risk factor for atherosclerosis.

Promote Bone Health

Sardines are not only a rich source of bone-building vitamin D, a nutrient not so readily available in the diet and one that is most often associated with fortified dairy products. Vitamin D plays an essential role in bone health since it helps to increase the absorption of calcium. Sardines are also a very good source of phosphorus, a mineral that is important to strengthening the bone matrix. Additionally, as high levels of homocysteine are related to osteoporosis, sardines' vitamin B12 rounds out their repertoire of nutrients that support bone health.

Promote Optimal Health

For many years, researchers have known that vitamin D, in the form of calcitriol, participates in the regulation of cell activity. Because cell cycles play such a key role in the development of cancer, optimal vitamin D intake may turn out to play an important role in the prevention of various types of cancer.

Packed with Protein

Sardines are rich in protein, which provides us with amino acids. Our bodies use amino acids to create new proteins, which serve as the basis for most of the body's cells and structures. Proteins form the basis of muscles and connective tissues, antibodies that keep our immune system strong, and transport proteins that deliver oxygen and nutrients throughout our bodies.

Description

Sardines are named after Sardinia, the Italian island where large schools of these fish were once found. While sardines are delightful enjoyed fresh, they are most commonly found canned, since they are so perishable. With growing concern over the health of the seas, people are turning to sardines since they are at the bottom of the aquatic food chain, feeding solely on plankton, and therefore do not concentrate heavy metals, such as mercury, and contaminants as do some other fish.

While there are six different types of species of sardines belong to the *Clupeidae* family, more than 20 varieties of fish are sold as sardines throughout the world. What these fish share in common is that they are small, saltwater, oily-rich, silvery fish that are soft-boned. In the United States, sardines actually refers to a small herring, and adult sardines are known as pilchards, a name that is commonly used in other parts of the world. Sardines are abundant in the seas of the Atlantic, Pacific and Mediterranean with Spain, Portugal, France, and Norway being the leading producers of canned sardines.

History

Sardines date back to time immemorial, but it was the emperor Napoleon Bonaparte who helped to popularize these little fish by initiating the canning of sardines, the first fish ever to be canned, in order to feed the citizens of the land over which he presided. Extremely popular in the United States in the 20th century, sardines are now making a comeback as people realize that they are an incredibly rich source of omega-3 fatty acids and vitamin D and that, because they are small fish at the bottom of the food chain, they are not as likely to contain concentrated amounts of contaminants such as mercury and PCBs.

How to Select and Store

Canned sardines packed in olive oil are preferable to those in soybean oil. Those concerned about their intake of fat may want to choose sardines packed in water. Look at the expiration date on the package to ensure that they are still fresh.

If you are purchasing fresh sardines, look for ones that smell fresh, are firm to the touch, and have bright eyes and shiny skin.

Pacific sardines are featured on the Super Green List of the Monterey Bay Aquarium Seafood Watch. The Super Green List is considered "the Best of the Best" in seafood; to receive this designation a fish or shellfish needed to be among their "Best Choices" for sustainability, provide at least 250 mg of omega-3s in an 8-ounce serving, and contain low levels of mercury (less than 216 ppb) and PCBs (less than 11 ppb).

Canned sardines can be stored in the kitchen cupboard, ideally one that is cool and not exposed to excessive heat. They have a long storage life; check the package for the expiration date so you know when you should use it by. Turn the can every now and then to ensure that all parts of the sardines are exposed to the oil or liquid in which they are packed; this will help keep them well-moistened. Unused portions of opened sardine cans should be refrigerated.

Fresh sardines are very perishable and normal refrigerator temperatures of 36-40F (2-4C) do not inhibit the enzymatic activity that causes them to spoil; they are best when stored at 28-32F (-2-0C). To store the fresh sardines, remove them from the store packaging, rinse them and place them in a plastic storage bag as soon as you bring them home from the market. Place in a large bowl and cover with ice cubes or ice packs to reduce the temperature of the fish. Remember to drain off the melted water and replenish the ice as necessary. Although fresh sardines will keep for a few days using this method, we recommend using the sardines as soon as possible, within a day or two. Don't forget that fish not only starts to smell but will dry out or become slimy if not stored correctly.

How to Enjoy

A Few Quick Serving Ideas

- Sprinkle sardines with lemon juice and extra virgin olive oil.
- Combine sardines with chopped onion, olives, or fennel.
- Top sardines with chopped tomatoes and basil, oregano, or rosemary.
- Balsamic vinegar gives sardines a nice zing.
- Make a sauce with extra virgin olive oil, lemon juice, pressed garlic, Dijon mustard, and salt and pepper. Serve over sardines.

Safety

Sardines and Food Allergies

Fish, such as sardines, are among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Sardines, Atlantic, canned
3.20 oz
90.72 grams

Calories: 189
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin B12	8.11 mcg	338	32.2	excellent
selenium	47.81 mcg	87	8.3	excellent
phosphorus	444.52 mg	64	6.1	very good
omega-3 fats	1.46 g	61	5.8	very good
protein	22.33 g	45	4.3	very good
vitamin D	175.09 IU	44	4.2	very good
calcium	346.54 mg	35	3.3	good
vitamin B3	4.76 mg	30	2.8	good
iodine	36.00 mcg	24	2.3	good
copper	0.17 mg	19	1.8	good
vitamin B2	0.21 mg	16	1.5	good
choline	68.04 mg	16	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Scallops

The soft fleshy texture and delicately mild sweet flavor of scallops are enjoyed by even those who are not particularly fond of fish or other shellfish. The season for fresh sea scallops and bay scallops runs from October through March, while fresh calico scallops are available from December through May. Sea scallops and frozen scallops are available year-round.

Scallops are mollusks that have two beautiful convexly ridged, or scalloped, shells. They consist of two shells hinged at one end which is why they are known to marine biologists as bi-valve mollusks. The edible portion of the scallop is the white muscle that opens and closes the two shells and is called the "nut." The reproductive glands known as "coral" are also edible, although not widely consumed in North America.

Scallops, steamed
4.00 oz
(113.40 grams)

Calories: 126
GI: low

Nutrient	DRI/DV
vitamin B12	102%
iodine	90%
phosphorus	69%
protein	47%
selenium	45%
choline	30%
zinc	16%
magnesium	10%
potassium	10%

Health Benefits

Most people know that fish is good for you, but what about other seafood? As it turns out, scallops, in addition to their delectable taste, contain a variety of nutrients that can promote your cardiovascular health, plus provide protection against colon cancer.

A Nutrient Team for Better Cardiovascular Health

Scallops are actually an excellent source of a very important nutrient for cardiovascular health, vitamin B12. Vitamin B12 is needed by the body to convert *homocysteine*, a chemical that can directly damage blood vessel walls, into other benign chemicals. Since high levels of homocysteine are associated with an increased risk for atherosclerosis, diabetic heart disease, heart attack, and stroke, it's a good idea to be sure that your diet contains plenty of vitamin B12 to help keep homocysteine levels low (homocysteine is also associated with osteoporosis, and a recent study found that osteoporosis occurred more frequently among women whose vitamin B12 status was deficient or marginal compared with those who had normal B12 status.)

In addition to their B12, scallops are a good source of magnesium and potassium, two other nutrients that provide significant benefits for the cardiovascular system. Magnesium helps out by causing blood vessels to relax, thus helping to lower blood pressure while improving blood flow. Potassium helps to maintain normal blood pressure levels.

Increases Heart Rate Variability—A Measure of Heart Muscle Function

One of the ways in which consuming fish rich in omega-3 fats, such as scallops, promotes cardiovascular health is by increasing heart rate variability (HRV), a measure of cardiac function, in as little as three weeks, according to a study published in the April 2005 issue of *Chest*.

By providing greater variability between beats, the marine omega 3 fatty acids, EPA and DHA, reduce the risk of arrhythmia and/or sudden death.

Researchers from Atlanta, GA, Boston, MA, and Cuernavaca, Mexico, took the HRV of 58 elderly patients every other day for two months to establish an HRV baseline for each participant. For the next 11 weeks, half of the study participants took a daily

2 gram supplement of fish oil and the other half took a daily 2 gram supplement of soy oil.

Patients in both groups experienced a significant increase in HRV, with those who took fish oil achieving a greater increase in a shorter time period. Patients who received fish oil experienced increased HRV within the first 2.7 weeks, whereas it took 8.1 weeks for a significant increase in HRV to be seen in the group taking soy oil.

On the other hand, while none of the study participants experienced significant negative side effects, 41% of participants in the fish oil group reported belching, compared to 16% in the soy oil group.

"Our findings contradict the current belief in the medical community that increasing the intake of omega-3 fatty acids produces only long-term cardiac benefits," said the study's lead author, Fernando Holguin, MD, Emory University School of Medicine, Atlanta, GA. "In fact, our study group showed improvements in heart function in as little as two weeks."

"Studies like this demonstrate that there are additional approaches we can take to protect ourselves from heart attacks," said Paul A. Kvale, MD, FCCP, President of the American College of Chest Physicians. "It's exciting to see the potential for omega-3 fatty acids in improving heart function when it complements a healthy lifestyle of exercising, maintaining a healthy weight, and getting eight hours of sleep." We'd add eating healthful foods to this proactive list. Rather than pop a daily pill, we'd rather enjoy a daily "dose" of delicious scallops, soyfoods, or tuna. For recipes certain to not only increase your heart rate variability but also your delight in eating, click Recipes.

Protection against Fatal Heart Arrhythmia

A healthy way of eating that includes at least 10 ounces of omega-3-rich fish each week improves the electrical properties of heart cells, protecting against fatal abnormal heart rhythms, suggests a study from Greece.

"Long-term consumption of fish is associated with lower QT interval in free-eating people without any evidence of cardiovascular disease. Thus, fish intake seems to provide anti-arrhythmic protection at a population level," wrote the authors in the American Journal of Clinical Nutrition. (Chrysohoou C, et al.)

The QT interval is a measure of the heart's electrical cycle, from the beginning of ventricular depolarization, the Q wave, to the end of the T wave, at which point cardiac repolarization is complete.

A lower QT score indicates a lower resting heart rate. As a higher resting heart rate has been linked to an increased risk of sudden death, the result of approximately 50% of heart attacks, lowering the resting heart rate provides significant health benefit.

Researchers at the University of Athens enrolled 3,042 people (1,514 men, aged 18-87, and 1,528 women, aged 18-89), who used a validated food frequency questionnaire to record their food intake of 156 different foods. Along with alcohol consumption and physical activity were also recorded, and electrocardiography was used to measure several indexes of study participants' heart rate.

After the raw data scan, those who ate more than 10 ounces (300 grams) of fish per week were found to have QT scores 13.6% lower than people who did not eat fish.

After adjusting the results for potentially confounding factors such as age, sex, physical activity status, BMI, smoking habits and intake of nuts, the reduction in QT scores in those eating 10 or more ounces of fish each week rose to 29.2%, compared to those who did not eat fish.

In an earlier study, Harvard researchers reported that among those consuming the most fish, heart rate was 2.3 beats per minute lower and likelihood of prolonged QT was 46% lower. Similar results were found in study participants taking 1 gram of omega-3s daily. The mechanism behind these benefits is thought to be omega-3 fats' effects on the flow of sodium and calcium in the ion channels, which are involved with electrical signaling in cells. Practical Tip: A typical serving of fish is 4 ounces, so just 3 servings of omega-3-rich fish, such as scallops, each week would provide 2 ounces more than the 10 ounces this research indicates confers significant protection against sudden death from a heart attack. For great, quick and easy recipe ideas, take a look at our Recipe Assistant.

Protection against Stroke

Eating fish, such as scallops, as little as 1 to 3 times per month may protect against ischemic stroke (a stroke caused by lack of blood supply to the brain, for example, as a result of a blood clot), suggests a meta-analysis of 8 studies published in the July 2004 issue of *Stroke*.

Data on nine independent groups participating in eight different studies found that, compared to those who never consumed fish or ate fish less than once per month, risk of ischemic stroke dropped:

- 9% in those eating fish 1 to 3 times per month
- 13% in those eating fish once per week
- 18% in those eating fish 2 to 4 times per week
- 31% in those eating fish 5 or more times each week

Eating Fish Daily Provides Substantially More Protection against Heart Attack

While as little as a weekly serving of fish lowers risk of ischemic stroke, enjoying a daily serving omega-3-rich fish, such as scallops, provides significantly greater reduction in the risk of coronary heart disease than eating fish even as frequently as a couple of times a week, show the findings of a study published in the January 17, 2006 issue of *Circulation*, the journal of the American Heart Association.

Researchers in Japan followed 41,578 men and women aged 40 to 59, none of whom had cardiovascular disease or cancer when the study began, from 1990-1992 to 2001. Food frequency questionnaires completed at the beginning of the study and in 1995, provided information on weekly fish intake, which was analyzed for omega-3 content.

When individuals whose fish consumption was in the top one-fifth of participants at 8 times per week were compared to those whose intake was in the lowest fifth at once per week, they were found to have a 37% lower risk of developing coronary heart disease and a 56% percent lower risk of heart attack.

When the effect of omega-3 fatty acid intake on cardiovascular risk was analyzed, coronary heart disease risk was lowered by 42% among those whose intake was the highest at 2.1 grams per day or more compared to those whose intake was the lowest at 300 milligrams per day. Those whose intake of omega 3s was in the top fifth received a 65% reduction in the risk of heart attack compared to those whose omega 3 intake was lowest.

The authors theorize that daily fish consumption is highly protective largely due to the resulting daily supply of omega-3 fatty acids, which not only reduce platelet aggregation, but also decrease the production of pro-inflammatory compounds called leukotrienes. Lowering leukotrienes reduces damage to the endothelium (the lining of the blood vessels), a key factor in the development of atherosclerosis.

"Our results suggest that a high fish intake may add a further beneficial effect for the prevention of coronary heart disease among middle-aged persons," note the study's authors.

Choose Broiled or Baked, but Not Fried Scallops to Reduce Risk of Atrial Fibrillation (Heart Arrhythmia)

Eating scallops that are broiled or baked, but not fried, may reduce risk of atrial fibrillation, the most common type of heart arrhythmia, especially in the elderly, according to a Harvard study published in the July 2004 issue of *Circulation*. In the 12-year study of 4,815 people 65 years of age or older, eating canned tuna or other broiled or baked fish 1 to 4 times a week correlated with increased blood levels of omega-3 fatty acids and a 28% lower risk of atrial fibrillation. Eating broiled or baked fish 5 times a week lowered risk even more—a drop in atrial fibrillation risk of 31%. Eating fried fish, however, provided no similar protection. Not only is fried fish typically made from lean fish like cod and Pollack that provide fewer omega-3 fatty acids, but in addition, frying results in the production of damaged, free-radical-laden fats in the fish as well as the frying oil.

In further research to determine if the omega-3 fats found in fish oil were responsible for fish's beneficial effects on the heart's electrical circuitry, Dariush Mozaffarian and colleagues from Harvard Medical School analyzed data on fish intake and electrocardiogram results from 5096 adults, aged 65 or older, who were enrolled in the Cardiovascular Health Study from 1989-1990.

Eating tuna or other broiled or baked fish at least once a week was associated with lower heart rate (-3.2 beats/minute) and a 50% lower likelihood of prolonged ventricular repolarisation (the period of time it takes the heart to recharge after it beats, so it can beat again), compared to those consuming fish less than once a month.

Consuming 1 gram/day of omega-3 fatty acids from fish was associated with 2.3 beats/minutes lower heart rate and a 46% lower risk of prolonged ventricular repolarisation. Eating fish at least 5 times per week was associated with an even healthier heart rhythm. However, eating fried fish (typically sold in the U.S. as fish burgers or fish sticks) was not associated with increased blood levels of omega 3 fats or any beneficial electrocardiogram results. In fact, a previous study led by the same researcher (Mozaffarian, Am J Cardiol 2006 Jan) found that while eating baked or broiled fish was linked to a slower but more powerful heart beat and lower blood pressure, eating fried fish was associated with heart muscle motion abnormalities, a reduced ejection fraction, lower cardiac output, and higher blood pressure. Since irregular heart beats are a major precipitating factor in sudden death due to cardiac arrest, promoting a healthy heart rhythm by eating baked or broiled—not fried—fish several times a week makes very good sense. Happily, as our recipes, such as our serving ideas for scallops (immediately below) show, it's a quick, easy and most importantly, delicious prescription.

Fish, Fruit and Vegetables Protective against Deep Vein Thrombosis, Pulmonary Embolism

Deep vein thrombosis is a dangerous condition in which blood clots develop in the deep veins of the legs, thighs or pelvis, causing swelling and pain. An embolism is created if a part or all of the blood clot in the deep vein breaks off from the site where it was created and moves through the venous system. If the clot lodges in the lung, a very serious condition, pulmonary embolism, arises.

Fortunately, a healthy way of eating offers significant protection, as demonstrated by a prospective study over 12 years that involved almost 15,000 middle-aged adults. While those eating the most red and processed meat doubled their risk of deep vein thrombosis (DVT), those in the upper 3 quintiles of fruit and vegetable intake had a 41-53% lower risk of DVT. And those eating fish at least once each week were found to have a 30-45% lower DVT risk. (Steffen LM, Folsom AR, et al.,*Circulation*.)

Practical Tip: For protection against deep vein thrombosis, increase your consumption of fruit and vegetables; eat fish at least once a week; and decrease consumption of red and processed meats.

Protection Against Cancer

A high intake of vitamin B12 has also been shown to be protective against colon cancer. Vitamin B12 helps to protect the cells of the colon from mutations as a result of cancer-causing chemicals—another good reason to eat plenty of vitamin B12. So add scallops, an excellent source of vitamin B12 and a very good of protein, to your list of healthy seafood and enjoy.

A Canadian study published in *Cancer Epidemiology Biomarkers*(Fritschi L, Ambrosini GL, et al.) suggests that eating fish frequently may provide serious protection against three types of cancer: leukemia, multiple myeloma, and non-Hodgkin's lymphoma. Researchers compared the diets of almost 3,000 individuals with these cancers to those of 4,200 healthy controls. People who ate the most fish and who got most of their total fat calories from fish were 28% less likely to have leukemia, 36% less likely to have multiple myeloma, and 29% less likely to have non-Hodgkin's lymphoma.

Omega-3-Rich Fish Protective against Colorectal Cancer

A diet rich in the omega-3 fats, which are found in scallops, greatly reduces risk of colorectal cancer, indicates a study comparing 1,455 subjects with colorectal cancer to 1,455 matched healthy controls.

Those whose diets provided the most omega-3s had a 37% reduction in colorectal cancer risk, compared to those whose diets provided the least. Colorectal cancer risk was 41% lower in those with the highest average intake of EPA, and 37% lower in those whose diets supplied the most DHA. (Theodoratou E, McNeill G, et al. *Am J Epidemiol*.)

Practical Tip: Each of the World's Healthiest Foods' fish is a good to excellent source of omega-3s. Let our Recipe Assistant provide you with delicious, quick ways to add more omega-3s to your healthy way of eating.

Fish and Whole Grains Highly Protective against Childhood Asthma

According to the American Lung Association, almost 20 million Americans suffer from asthma, which is reported to be responsible for over 14 million lost school days in children, and an annual economic cost of more than $16.1 billion.

Increasing consumption of whole grains and fish could reduce the risk of childhood asthma by about 50%, suggests the International Study on Allergy and Asthma in Childhood (Tabak C, Wijga AH, *Thorax*).

The researchers, from the Dutch National Institute of Public Health and the Environment, Utrecht University, University Medical Center Groningen, used food frequency questionnaires completed by the parents of 598 Dutch children aged 8-13 years. They assessed the children's consumption of a range of foods including fish, fruits, vegetables, dairy and whole grain products. Data on asthma and wheezing were also assessed using medical tests as well as questionnaires.

While no association between asthma and intake of fruits, vegetables, and dairy products was found (a result at odds with other studies that have supported a link between antioxidant intake, particularly vitamins C and E, and asthma), the children's intake of both whole grains and fish was significantly linked to incidence of wheezing and current asthma.

In children with a low intake of fish and whole grains, the prevalence of wheezing was almost 20%, but was only 4.2% in children with a high intake of both foods. Low intake of fish and whole grains also correlated with a much higher incidence of current asthma (16.7%). compared to only a 2.8% incidence of current asthma among children with a high intake of both foods.

After adjusting results for possible confounding factors, such as the educational level of the mother, and total energy intake, high intakes of whole grains and fish were found to be associated with a 54 and 66% reduction in the probability of being asthmatic, respectively.

The probability of having asthma with bronchial hyperresponsiveness (BHR), defined as having an increased sensitivity to factors that cause narrowing of the airways, was reduced by 72 and 88% when children had a high-intake of whole grains and fish, respectively. Lead researcher, CoraTabak commented, "The rise in the prevalence of asthma in western societies may be related to changed dietary habits." We agree. The Standard American Diet is sorely deficient in the numerous anti-inflammatory compounds found in fish and whole grains, notably, the omega-3 fats supplied by cold water fish and the magnesium and vitamin E provided by whole grains. One caution: wheat may need to be avoided as it is a common food allergen associated with asthma.

Protection against Alzheimer's and Age-related Cognitive Decline

Can eating fish high in the omega-3 fatty acids, DHA(docosahexaenoic acid) and EPA (eicosapentaenoic acid), help lessen the cognitive decline and Alzheimer's disease growing in our aging population? A number of studies indicate the answer to this question is a resounding "Yes."

A report from the Framingham Heart Study published in the *Archives of Neurology* showed that persons whose blood levels of DHA placed them in the top quartile of values had a significantly (47%) lower risk of developing all-cause dementia than did those in the bottom quartile. Plus, greater protection against cognitive decline was obtained from consuming 2.9 than 1.3 fish meals per week. (Schaefer EJ, Bongard V, et al.).

Now, two additional positive studies have been published in the *American Journal of Clinical Nutrition*:

In the Zutphen Elderly Study, which involved 210 men aged 70-89 years (van Gelder BM, Tijhuis M, et al.), a linear relation was found between the estimated intake of DHA and EPA and prevention of cognitive decline.

A DHA+EPA intake of approximately 380 mg per day seemed to prevent cognitive decline. This amount of DHA+EPA would be found in just 20 grams (just 2/3 of one ounce) of Chinook salmon or in 100 grams (about 3 ounces) of cod.

Eating just two to three meals of fish a week would supply approximately 380 mg EPA+DHA per day.

In the Minneapolis study (Beydoun MA, Kaufman JS et al.) of 2251 men and women, risk of cognitive decline increased as levels of omega-6 (arachidonic acid) increased in subjects' cholesterol and other blood lipids, but decreased as the concentration of omega-3 fat (linoleic acid) increased in their blood fats.

Among subjects with high blood pressure and high cholesterol, cognitive decline was clearly associated with lower blood levels of omega-3 fats (DHA+EPA).

In all of these studies, fish consumption and the resulting increase in blood levels of omega-3 fatty acids significantly lessened mental decline over time.

How? A number of mechanisms have been suggested in recent studies to explain fish's protective effects against cognitive decline and Alzheimer's:

- EPA's anti-clotting and anti-inflammatory actions promote a healthy blood supply to the brain and lower inflammation.
- Since EPA and arachidonic acid are metabolized by the same enzymes, an increase in levels of EPA helps lessen the production of the pro-inflammatory compounds derived from arachidonic acid. (Arachidonic acid is a precursor of proinflammatory cytokines eicosanoids that are thought to be associated with greater cognitive decline.)
- Increasing consumption of DHA may correct the DHA deficiency in the cerebral cortex characteristically seen in patients with Alzheimer disease.
- DHA is involved in the membrane of ion channels in the brain, making it easier for them to change shape and transmit electrical signals.

- DHA is the source of an anti-inflammatory compound made in the brain called NPD1 that lessens amyloid-beta production in cytokine-stressed human brain cells.
- DHA slows the accumulation of tau, a protein involved in the development of neurofibrillary tangles, and also decreases beta amyloid formation by reducing levels of presenilin, the enzyme that separates beta amyloid from its parent protein. (Neurofibrillary tangles and beta amyloid plaques are the two types of brain lesions seen in Alzheimer's disease.)

Frank LaFerla, co-author of research published in the *Journal of Neuroscience* showing that DHA helps prevent the formation of neurofibrillary tangles and decreases beta amyloid formation, commented: "We are greatly excited by these results, which show us that simple changes in diet can positively alter the way the brain works and lead to protection from Alzheimer's disease pathology." Practical Tip: To keep your cognitive edge, cut back on sources of omega-6 fats, such as beef, and corn, palm, peanut, safflower and sunflower oils, and enjoy omega-3-rich cold water fish, such as scallops, at least 3 times each week.

Omega-3 Fat, DHA, Destroys Alzheimer's Plaques

DHA boosts production of the protein LR11, which destroys the beta-amyloid plaques associated with Alzheimer's disease, shows brain cell research.

"Because reduced LR11 is known to increase beta-amyloid production and may be a significant genetic cause of late-onset Alzheimer's disease (LOAD), our results indicate that DHA increases in LR11 levels may play an important role in preventing LOAD," wrote the researchers in the *Journal of Neuroscience*.

"Genetic polymorphisms that reduce LR11 expression are associated with increased AD risk," explained the researchers. "However these polymorphisms account for only a fraction of cases with LR11 deficits, suggesting involvement of environmental factors."

The new research investigated if fish oil and DHA could boost LR11 levels, since having high levels of LR11 have been reported to prevent plaque formation, while low levels in patients are believed to be a factor in causing the disease.

Even low doses of DHA increased the levels of LR11 in rat brain cells. Dietary DHA increased LR11 levels in the brains of rats or older mice genetically engineered to develop Alzheimer's disease. The positive effects of DHA on LR11 levels and the protection against Alzheimer's was again seen human brain cells were used. (Ma QL, Teter B, et al. *J Neurosci.*)

As a result of these findings, the National Institutes of Health has begun a large-scale clinical trial with DHA in patients with well established Alzheimer's disease. Lead researcher, Greg Cole, associate director of UCLA's Alzheimer Disease Research Center, thinks it may be too late for DHA to benefit these patients, but that DHA is highly likely to benefit patients in the earliest stages of Alzheimer's. And, we would add, help prevent the development of the disease in the rest of us!

DHA is the most abundant essential fatty acid in the brain, is crucial for healthy brain development, and low levels have been linked to cognitive impairment. According to the national Alzheimer's Association, approximately 5.1 million Americans suffer from Alzheimer's disease, a number that is projected to increase to 11 to 16 million sufferers by 2050.

Practical Tip: Enjoying several weekly servings of fish high in DHA, such as scallops, is a smart move.

Omega-3-Rich Diet Improves Mood, Reduces Depression

When researchers from Ohio State University evaluated blood samples taken from 43 older adults (average age 67), they found that study participants with high ratios of omega-6 to omega-3 not only had higher levels of various compounds involved in inflammation, but were more likely to suffer from depression.

Both depression and stress promote the production of pro-inflammatory cytokines. Researchers measured a number of these pro-inflammatory compounds including tumour necrosis factor-alpha (TNF-alpha), interleukin-6 (IL-6), and the IL-6 soluble receptor (sIL-6r). Symptoms of depression were assessed using the Center for Epidemiological Studies Depression Scale.

Levels of pro-inflammatory cytokines increased progressively as depressive symptoms increased. But when depressive symptoms were combined with high omega-6:omega-3 ratios, levels of proinflammatory cytokines skyrocketed by up to 40% more than normal—far beyond the 18% increase resulting from the presence depressive symptoms alone.

Chronic inflammation has already been linked to heart disease, type 2 diabetes, osteoporosis, cognitive decline and Alzheimer's. Earlier epidemiological (population) studies have also linked higher levels of pro-inflammatory cytokines with depressive symptoms. This new study suggests that a diet that is rich in omega-6 fats but includes few of the foods rich in omega-3 fats—such as the standard American diet—promotes not only inflammation, but depression.

The positive take-away is that increasing consumption of foods rich in omega-3s, while decreasing consumption of omega-6-rich foods, can provide some protection against depression, particularly as depressive symptoms increase.

Omega-3s are found in cold water fish, nuts, such as walnuts, and flaxseeds. Alpha-linolenic acid (ALA), the omega-3 in nuts and seeds, can be converted—albeit inefficiently—in the body to the omega-3s found in fish, eicosapentaenoic acid (EPA) and docosahexaenioc acid (DHA).

EPA improves blood flow and is also suggested to affect hormones and the immune system, both of which have a direct effect on brain function. DHA is active in the membrane of ion channels in the brain, making it easier for them to change shape and transmit electrical signals, and is involved in serotonin metabolism (reduced serotonin production and/or activity is a key factor in depression). Practical Tip: Be of good cheer. Cut back on sources of omega-6 fats, such as beef, and corn, palm, peanut, safflower and sunflower oils. Enjoy a handful of omega-3-rich walnuts and/or flaxseeds daily, and a serving of cold water fish, such as scallops, at least 3 times each week.

Description

Scallops are mollusks that have two beautiful convexly ridged, or scalloped, shells. Their two-part shell is why scallops are viewed by marine scientists as bi-valve mollusks. The part of the scallop that is generally consumed is the nut, the white muscle that opens and closes the two shells. It has a soft, fleshy texture and a delicate flavor that may be mild or briny depending upon the variety. The coral, the reproductive glands, are also edible, although they are not widely consumed in North America.

In the United States, the most widely available types of scallops include the Atlantic deep-sea scallop and the bay scallop. The flesh of the sea scallop is large, usually about one-and-a-half inches in diameter, while the bay scallop is tiny, averaging about one-half of an inch in diameter. In Europe, the most popular type is the great scallop, more commonly called Coquille St Jacques. Several hundred different species of scallops are found worldwide, in shallow areas of most seas. The Latin name of the common bay scallop is *Agropecten irradians*.

History

People have been enjoying scallops as a food ever since this beautiful mollusk appeared in the Earth's waters, basically since time immemorial.

The great scallop gained great prestige during the medieval era. Pilgrims visiting the shrine of St. James in Spain began to use empty scallop shells for both eating and begging. The scallop and its shell quickly became a symbol of this magnificent shrine with people using them to decorate their doorways as well as their coats of arms. In honor of the shrine, they were called the shell of St. James, now best known by their translated French name of Coquille St. Jacques.

Scallops are found in many waters throughout the world. The great scallop is abundant in the Mediterranean, while the sea and bay scallop are found concentrated in the Atlantic Ocean off North America.

How to Select and Store

Just as with any seafood, it is best to purchase scallops from a store that has a good reputation for having a fresh supply of fish. Get to know a fishmonger (person who sells the fish) at the store so that you can have a trusted resource from whom you can purchase your seafood.

Since scallops are extremely perishable, they are usually shelled, washed and frozen, or packed in ice, as soon as they are caught.

Fresh scallops should have flesh that is white and firm and have no evidence of browning. Frozen scallops should be solid and shiny, and the inside of their packaging should be free of frost. If you are planning on freezing the scallops, make sure to ask the fishmonger whether they are fresh or defrosted (if it is not clearly marked) since you will need to cook previously frozen scallops before refreezing.

Smell is a good indicator of freshness with fresh scallops being either odorless or having a slightly sweet scent. Since a slightly "off" smell cannot be detected through plastic, if you have the option, purchase displayed scallops as opposed to those that are prepackaged. Once the fishmonger wraps and hands you the scallops that you have selected, smell them through the paper wrapping and return them if they do not smell right.

When storing all types of seafood, including scallops, it is important to keep it cold since seafood is very sensitive to temperature. Therefore, after purchasing scallops or other seafood, make sure to return it to a refrigerator as soon as possible. If the scallops are going to accompany you during a day full of errands, keep a cooler in the car where you can place the scallops to make sure they stay cold and do not spoil.

The temperature of most refrigerators is slightly warmer than ideal for storing seafood. Therefore, to ensure maximum freshness and quality, it is important to use special storage methods so as to create the optimal temperature for holding the scallops. One of the easiest ways to do this is to place the scallops, which have been well wrapped, in a baking dish filled with ice. The baking dish and scallops should then be placed on the bottom shelf of the refrigerator, which is its coolest area. Replenish the ice one or two times per day. Scallops can be refrigerated for up to two days, although they should be purchased as close to being served as possible.

You can extend the shelf life of scallops by freezing them. To do so, wrap them well in plastic and place them in the coldest part of the freezer where they will keep for about three months. To defrost frozen scallops, place them in milk (or water) that has been boiled and removed from the heat. Alternatively, they can be placed in the refrigerator to defrost.

How to Enjoy

A Few Quick Serving Ideas

- Serve lightly cooked bay scallops with a salsa made from diced papaya, cilantro, jalapeno peppers and ginger.
- Skewer marinated scallops, leeks and cherry tomatoes, and broil in the oven. Brush with garlic olive oil when done.
- Add bay scallops to your gazpacho for extra flavor and nutrients.
- Healthy Sauté scallops with ginger, shiitake mushrooms and scallions.

For some of our favorite recipes, click Recipes.

Safety

For information on the topic of seafood and mercury contamination, please see our article "Should I be concerned about mercury in fish and what fish are safe to eat?"

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Scallops, steamed
4.00 oz
113.40 grams

Calories: 126
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin B12	2.44 mcg	102	14.5	excellent
iodine	135.00 mcg	90	12.9	excellent
phosphorus	483.08 mg	69	9.9	excellent
protein	23.29 g	47	6.7	very good

selenium	24.61 mcg	45	6.4	very good
choline	125.53 mg	30	4.2	very good
zinc	1.76 mg	16	2.3	good
magnesium	41.96 mg	10	1.5	good
potassium	356.07 mg	10	1.5	good

World's Healthiest Foods Rating	**Rule**
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Shrimp

What's New and Beneficial About Shrimp

- Shrimp can be a unique source of the antioxidant and anti-inflammatory carotenoid nutrient astaxanthin. It is possible for a single 4-ounce serving of shrimp to contain 1-4 milligrams of astaxanthin. In animal studies, astaxanthin has been shown to provide antioxidant support to both the nervous system and musculoskeletal system. In addition, some animal studies have shown decreased risk of colon cancer to be associated with astaxanthin intake, as well as decreased risk of certain diabetes-related problems. Importantly, the astaxanthin content of shrimp can vary widely, mostly in proportion to the amount of astaxanthin in their diet. In addition, the source of astaxanthin in the diet of shrimp remains an ongoing controversy. Since over half of the shrimp consumed both in the U.S. and worldwide are farmed, the diets that they consume depend on the approach of the producers. Both synthetic forms of astaxanthin and naturally occurring forms found in phytoplankton and zooplankton have been used in shrimp farming. In general, when purchasing farmed shrimp, we believe that it makes sense to select shrimp that have consumed natural and plentiful amounts of astaxanthin from natural dietary sources including marine algae and zooplankton. You will find more recommendations regarding shrimp selection in our How to Select and Store and Individual Concerns sections below.
- At 56 micrograms in every 4 ounces, shrimp is an excellent source of the antioxidant mineral selenium. Recent research studies show that the selenium contained in shrimp can be well absorbed into the human body. In one study, we've seen an estimate of about 80-85% for total selenium absorption from this shellfish. Since selenium deficiency has been shown to be a risk factor for heart failure and other forms of cardiovascular disease, as well as for other problems including type 2 diabetes, compromised cognitive function, and depression, shrimp may have a unique role to play in your meal plan if your health history places you at special risk in any of these areas.
- A second mineral benefit often overlooked in shrimp is its unusual concentration of copper. Not only does shrimp rank as a very good source of copper at WHFoods, but it is also our only fish to achieve this very good rating. Several recent studies show the copper richness of shrimp to be a standout among other fish. Researchers have pointed to a copper-containing protein in shrimp called hemocyanin as a likely reason for shrimp's unique copper richness. (This copper-containing protein is involved is the shrimp's oxygen metabolism.)
- Shrimp is often included on the "avoid" list for persons wanting to minimize their dietary intake of cholesterol. The 220 milligrams of cholesterol contained in a 4-ounce serving of shrimp makes this approach a legitimate concern. However, despite its high cholesterol content, several recent research studies have noted some desirable aspects of the fat profile in shrimp. One of these desirable aspects is shrimp's omega-3 fat content. Four ounces of shrimp provides about 325 -375 milligrams of omega-3 fatty acids, including about 50% EPA (eicosapentaenoic acid) and 50% DHA (docosahexaenoic acid). EPA and DHA are especially important omega-3s for cardiovascular and nervous system health. In addition to this great mixture of omega-3s, shrimp also provides an unusual omega-3:omega-6 ratio of approximately 1:1. Since higher ratios of omega-3:omega-6 are associated with decreased risk of many chronic diseases—including obesity, high blood pressure, and type 2 diabetes—this aspect of shrimp's fat content should be a huge plus, especially in meal plans with excessive amounts of omega-6s. Finally, it is interesting to note that according to recent studies, cholesterol is not the only sterol in shrimp. This type of fat is found in smaller amounts in the form of clionasterol and campesterol. While chemically similar to cholesterol, these other sterols function as anti-inflammatory molecules and they are associated with decreased levels of LDL-cholesterol, which would be considered a health benefit by many researchers. When looked at from this broader perspective, risks related to the high cholesterol content of shrimp might be overshadowed by its omega-3 and sterol composition—but we will need future studies to help us understand more about the big picture involving shrimp and fat. As always, if you have concerns that have you need to be cautious about cholesterol intake, discuss the inclusion of shrimp in your diet with your healthcare practitioner.

Shrimp, large, steamed
4.00 oz
(113.40 grams)

Calories: 135
GI: very low

Nutrient	DRI/DV
selenium	102%
vitamin B12	78%
protein	52%
phosphorus	50%
choline	36%
copper	32%
iodine	31%
vitamin B3	19%

zinc	17%
vitamin E	17%
vitamin B6	16%
omega-3 fats	14%
pantothenic acid	12%
vitamin A	11%

Health Benefits

Anti-Inflammatory and Antioxidant Support

We don't usually think about seafood as a source of antioxidants, but shrimp features at least three unique antioxidants in its nutrient composition: the xanthophyll carotenoid called astaxanthin, and the minerals selenium and copper.

Astaxanthin

Astaxanthin is the primary color pigment in many shrimp, and it helps provide their tissue with its red and orange shades. While many reddish-orange foods get their color from other carotenoids (or from flavonoids), shrimp are especially concentrated in this one particular type of carotenoid. (Astaxanthin often accounts for at least two-thirds of all carotenoids in shrimp.) It is possible for a 4-ounce serving of shrimp to contain 1-4 milligrams of astaxanthin. In animal studies, astaxanthin has been shown to provide antioxidant support to both the nervous system and musculoskeletal system. In addition, some animal studies have shown decreased risk of colon cancer to be associated with astaxanthin intake, as well as decreased risk of certain diabetes-related problems. Under natural conditions, shrimp get astaxanthin through their diet, by consuming smaller organisms that contain this carotenoid, including algae and zooplankton. When farmed, the astaxanthin content of shrimp depends on the composition of their feed. Both synthetic forms of astaxanthin and naturally occurring forms of astaxanthin have been used in shrimp farming, and the use of synthetic astaxanthin remains a topic of ongoing controversy. In general, when purchasing farmed shrimp, we believe that it makes sense to select shrimp that have consumed natural and plentiful amounts of astaxanthin from natural dietary sources including marine algae and zooplankton. You will find more recommendations regarding shrimp selection in our How to Select and Store and Individual Concerns sections below.

Selenium and Copper

In the world of antioxidants, few enzymes are more important in our body than glutathione peroxidase (GPO). GPO helps protect most of our body systems from unwanted damage by oxygen-containing molecules. It is critical in body systems like the lungs, where exposure to these molecules is especially high. GPO is an enzyme that cannot function without the mineral selenium.

At 56 micrograms in every 4 ounces, shrimp is an excellent source of this antioxidant mineral. Shrimp is not only rich in selenium; research studies show that the selenium found in shrimp can be well-absorbed into the human body. In one study, we've seen an estimate of about 80-85% for total selenium absorption from this shellfish. In addition to risk of problems involving lung function, selenium deficiency has been shown to increase our risk of heart failure and other forms of cardiovascular disease, as well as for other problems including type 2 diabetes, compromised cognitive function, and depression.

Copper is also classified as an antioxidant mineral, and one of its key roles in our health is related to the function of an enzyme called copper-zinc superoxide dismutase (SOD). SOD is found in the major fluid compartment of our cells (called the cytosol) and it is known to play a major role in regulation of oxygen metabolism and prevention of oxidative stress. Shrimp is our only fish at WHFoods to qualify as a "very good" source of copper in our rating system and it stands out in this respect as a source of antioxidant minerals. Not be overlooked, of course, is the fact that we also rank shrimp as a good source of zinc—the second mineral required for effective SOD function.

Protein and Peptide Support

At nearly 26 grams per 4-ounce serving, shrimp ranks as a very good source of protein at WHFoods, and provides over half of the Daily Value (DV) in each serving. In fact, among all WHFoods, shrimp ranks as our 8th best source of protein. The protein richness of shrimp is one of the reasons this shellfish is relied on in so many different culinary traditions.

When the protein in fish (or any other food) is broken down during digestion, smaller protein fragments called peptides are formed. (Peptides are chains of amino acids. Proteins are too, but they are longer chains and more complicated in their structure.) Some relatively short peptides—consisting of only 10-25 amino acids—have been found to be present in partially digested shrimp proteins and appear able to stimulate release of the hormone cholecystokinin (CCK) from cells that line our intestinal tract. Release of CCK is important for many reasons, including the role of CCK in regulating appetite. Our feeling of satiety (lack of appetite) is partly related to the levels of CCK in our digestive tract. By helping trigger release of CCK, shrimp peptides may play a role in helping us feel full. In the long run, this feeling of satiety may also be an advantage in helping to decrease our risk of obesity. Research on shrimp peptides and satiety is in its early stage, and largely limited to animal studies at this point. But we expect to see increasing interest in this area of shrimp and health.

Other Health Benefits

At only 7 calories per shrimp, we can eat a relatively large amount of this shellfish without using up too many of our daily calories. For example, a person eating 1,800 calories per day could consume 20 shrimp and only be "spending" about 8% of his or her daily calories. This very low calorie cost would not be so remarkable if it were not for the fact that shrimp provides us with significant amounts of so many nutrients. We usually have to eat foods with a far greater calorie content to get the nutrient richness provided by shrimp. For example, those same 20 shrimp that provide us with about 140 calories also provide us with 25 grams of protein or 50% of the Daily Value (DV).They also provide nearly 2 micrograms of vitamin B12—over 80% of the Dietary Reference Intake (DRI) level for adults. When this nutrient richness list for shrimp is continued across the list of other vitamins and minerals provided by this fish, it becomes striking how much nourishment can be provided by shrimp for less than 10% of a total day's calories.

Description

Shrimp are crustaceans (just like lobsters and crabs) and they belong to a category of living things called arthropods. Like all arthropods, shrimp have their skeleton on the outside instead of the inside) and this outer skeleton (technically called an exoskeleton) is one of the features that gives shrimp their unusual look—almost like having a head shield that blocks out all of their features except their eyes, mouth opening, and antennae. In the U.S., consumers don't typically eat the outer skeleton, heads, or tails of shrimp, even though these parts are often rich in nutrients and commonly consumed in most other countries. Shrimp account for about 30% of all seafood consumed in the U.S. Out of 14-15 pounds of total seafood per year consumed by the average U.S. adult each year, about 4-5 pounds come from shrimp. (Salmon and tuna have typically engaged in a tug-of-war for second place, and are typically consumed in average amounts of approximately 2-3 pounds per year. Shrimp are produced, sold, and consumed in a variety of different forms, including fresh, frozen, breaded, cooked, dried, and in paste form. In addition, you will find shrimp that are peeled, unpeeled, veined, deveined, and with head on or head off.

It would be difficult to find a WHFood with greater diversity than shrimp. While we are accustomed to thinking about foods like potatoes as involving a wide variety of colors and shapes (for example, large brown russets, medium sized golds, or small fingerlength reds), there are hundreds of commercially important shrimp species and literally thousands of total species worldwide. Yet, there is no relationship between the species of a shrimp and its color. You can find pink, red, white, brown, blue, and green shrimp, but within each of these color categories can be found a wide variety of shrimp species. No less diverse are the habitats of shrimp. These remarkable crustaceans can live in freshwater, saltwater, brackish water, or a combination of habitats. (Brackish water—also sometimes called briny water—is simply water that falls in between freshwater and saltwater. It is more salty than freshwater and less salty than saltwater.) In terms of saltwater habitats, the Pacific, Atlantic, and Indian Oceans serve as the top three saltwater habitats for shrimp. Added to this unusual diversity of habitats is the tendency of some researchers to group shrimp together based on the average water temperature of their environment. Warm-water shrimp come from tropical waters in southern parts of the world, and cold-water shrimp come from colder northern waters.

The terms "shrimp" and "prawns" can be confusing. Even scientists often use these words inconsistently. In the popular press and in many restaurants, larger shrimp—often from freshwater habitats—are referred to as "prawns," while smaller shrimp—often from saltwater habitats—are called "shrimp." In terms of size, "large" typically means that you get about 40 or less per cooked pound (in comparison to about 50 for "medium" and 60 for "small"). But from a science perspective, both shrimp and prawns can come from saltwater or freshwater, and there is no absolute standard for measuring small, medium, or large. In this article and throughout our website, we'll be using the word "shrimp" as a general term that includes all species—even those which might be referred to as "prawns" in some research studies or in some restaurants.

Many people ask about the way shrimp sizes (small, medium, large, jumbo) are determined. While there is no precise method typically used for shrimp sizing, count per pound is the most common method used. (Count per pound refers to the number of shrimp that you get when you purchase or consume one pound.) With small cooked shrimp, that number is usually around 60. With medium cooked shrimp, it falls to about 50 (since the shrimp are bigger, and each one weighs more). For large shrimp, the count per pound is about 40. For jumbo shrimp the count per pound is about 30.

We have created the chart below to give you a better idea about the amazing diversity of shrimp. As you will see in the chart, there are numerous shrimp families, and within any given family, you will find examples of shrimp that are being referred to by a particular color, or by the name "prawn" versus "shrimp." However, these common names do not necessarily provide you with helpful information about the nutrient content of the shrimp, since that nutrient content typically depends more on the species of shrimp and its lifelong habitat (including of course, its diet).

Classification of Various Shrimp as Crustaceans (Decapoda Order)

Suborder	Family	Genus	Species
Dendrobranchiata			
	Penaeidiae		
		Farfantepenaeus	
			aztecus (brown shrimp)
			brasiliensis (pinkspotted shrimp)
			brevirostris (crystal shrimp, pink shrimp)
			californiensis (yellowleg shrimp)
			duorarum (pink shrimp)
			paulensis (pink shrimp)
			subtilis (southern brown shrimp)
		Fenerropenaeus	
			chinensis (fleshy prawn)
			indicus (Indian white shrimp)
			merquiensis (banana prawn)
			penicillatus (redtail prawn)
		Litopenaeus	
			schmitti (white shrimp)
			setiferus (white shrimp)
			stylirostris (blue shrimp)
			vannamei (Pacific white shrimp)
		Penaeus	
			esculentus (brown tiger prawn)
			monodon (black tiger shrimp)
			semisulcatus (green tiger prawn)
	Sicyoniidae (rock shrimps)		
		Sicyonia	
			burkenroadi (spiny rock shrimp)
			brevirostris (coral shrimp)
			dorsalis (lesser rock shrimp)
			ingentis (ridgeback rock shrimp)
			lancifer (knight rock shrimp)
	Solenoceridae (solenocerid shrimps)		
		Pleoticus	
			mulleri (Argentine red shrimp)
			robustus (royal red shrimp)
		Solenocera (humpback shrimps)	

			agassizzi (kolibri shrimp)
			crassicornis (coastal mud shrimp)
			koelbeli (Chinese mud shrimp)
			vioscai (humpback shrimp)
Pleocyemata			
	Crangonidae		
		Crangon	
			alaskensis (Alaskan bay shrimp)
			crangon (brown shrimp)
			franciscorum (California bay shrimp)
			septemspinosa (sand shrimp)
		Pontophilus	
			norvegicus (Norwegian shrimp)
	Palaemonidae (palaemonid shrimps)		
		Macrobrachium	
			malcomsonii (monsoon river prawn)
			nipponense (oriental river prawn)
			rosenbergii (giant freshwater prawn)
		Palaemon	
			varians (Atlantic ditch shrimp)
	Pandalideae (pandalid shrimps)*		
		Dichelopandalus	
			bonnieri (whip shrimp)
			leptocerus (bristled longbeak)
		Pandalus	
			borealis (northern shrimp)
			eous (northern pink shrimp)
			hypsinotus (coonstripe shrimp)
	Hippolytidae		
		Ealus	
			abricii (Arctic eualid)
		Lebbeus	
			polaris (polar shrimp)
			groenlandicus (spiny lebbeid)
		Spirontocaris	
			lamellicornis (Dana's blade shrimp)
			liljeborgii (friendly blade shrimp)
			spinus (parrot shrimp)

* The name "caridean shrimp" is also sometimes used to refer to panadalid shrimp from the Pandalideae family (and from three other shrimp families as well). It is based on a scientific classification rank called an "infraorder."

Unfortunately, there is no way to take this amazing diversity of shrimp species and narrow it down to some simple set of shrimp recommendations that is based primarily on species or habitat. Some natural habitats remain fairly healthy and well suited for shrimp harvesting, and other do not. Similarly, it is important to remember that about 55% of shrimp consumed in the U.S. and worldwide are presently farmed, and the quality of shrimp farming conditions can also vary widely. Some farmed shrimp are raised in fully recirculating, fully open, or other types of systems that are carefully monitored and that come closer to approximately natural conditions than other types of shrimp farms. In addition, the diet fed to farmed shrimp can vary widely, and in some cases incorporates natural feedstocks involving both algae and zooplankton.

As a result of these many different factors, some shrimp raised under farmed conditions may provide a favorable option to non-farmed shrimp that have lived in contaminated and/or overfished habitats. While we recognize the ongoing nature of environmental debates over farmed fish (aquaculture) versus caught fish (catch fishery), we believe that in today's marketplace—and based on research studies about the nutrient content of shrimp—your best bet when selecting shrimp is to follow the recommendations of an organization that continually monitors shrimp quality in the U.S. marketplace and makes recommendations based on a combination of actual marketplace and environmental factors rather than any single, pre-established criterion (for example, farmed versus caught, freshwater versus saltwater, Atlantic Ocean versus Pacific Ocean, large versus small, etc.). In our Individual Concerns section, we provide you with website links to some of seafood monitoring organizations that rank at the top of our recommendation list for making shrimp choices.

History

It's virtually impossible to find a continent or major world location in which shrimp has not been traditionally enjoyed as a part of local cuisine. Whether you look to North America, Central America, South America, Europe, the Mediterranean, Africa, the Middle East, Asia, Australia, or the Arctic, you will find traditions in which shrimp have been enjoyed as a regular part of the meal plan. That's why you will find 2014 imports of shrimp into the U.S. from about two dozen different countries, including India, Bangladesh, Thailand, Indonesia, Vietnam, Malaysia, China, Ecuador, Peru, Venezuela, Argentina, Honduras, Panama, Nicaragua, Canada, Mexico, and the Philippines. Similarly, you will find capture fisheries and aquaculture being practiced in most of these countries, as well as others.

About 55% of global commercial shrimp is currently farmed. *Litopenaeus vannemei* (Pacific white shrimp) is the most widely farmed single species. Other widely farmed species include *Macrobrachium rosenbergii* (giant freshwater prawn) and *Penaeus monodon* (black tiger shrimp). *Crangon crangon* (brown shrimp) are among the most widely caught shrimp species. Many observers expect shrimp farming to increase over the next decade, with a heightened focus on aquafeed management, broodstock, larviculture, and growout. It remains to be seen whether overall shrimp farming practices will be able to develop in ways that can further recognize and accommodate some of the barriers inherent with aquaculture, and whether the overall quality of farmed shrimp will compare favorably or unfavorably to overall quality of wild shrimp. As stated in the previous section, however, we believe that it does not make sense to purchase your shrimp based on any single criterion, regardless of whether that criterion is farmed versus caught, freshwater versus saltwater, etc. Instead, we believe that your best bet is to follow the recommendations of an organization that continually monitors shrimp quality and makes its recommendations based on a combination of many different factors. In our Individual Concerns section below, we provide practical recommendations in this regard.

How to Select and Store

Just as with any seafood, it is best to purchase shrimp from a store that has a good reputation for having a fresh supply. Get to know a fishmonger (person who sells the seafood) at the store so that you can have a trusted resource from whom you can purchase your seafood.

When you will be preparing the shrimp should influence your decision as to whether you should buy fresh or frozen shrimp. Frozen shrimp offer the longest shelf life, as they are able to be kept for several weeks, whereas fresh shrimp will only keep for a day or two. We think about fresh shrimp as a very perishable food, ideally eaten on the same day as they are purchased.

Fresh shrimp should have firm bodies that are still attached to their shells. They should be free of black spots on their shell since this indicates that the flesh has begun to break down. In addition, the shells should not appear yellow or gritty as this may be indicative that sodium bisulfate or another chemical has been used to bleach the shells.

Smell is a good indicator of freshness; good quality shrimp have a slightly saltwater smell. Since a slightly "off" smell cannot be detected through plastic, if you have the option, purchase displayed shrimp as opposed to those that are prepackaged. Once the fishmonger wraps and hands you the shrimp that you have selected, smell them through the paper wrapping and return them if they do not smell right. When fresh shrimp have been left out for too long, some people describe them as having an "ammonia" smell.

Color can also be an indicator of poor fresh shrimp quality. Unless you are purchasing spotted or striped shrimp, you should not see dark spots or rings of any kind. These markings are usually a sign of deterioration.

When storing any type of seafood, including shrimp, it is important to keep it cold since seafood is very sensitive to temperature. Therefore, after purchasing shrimp or other seafood, make sure to return it to a refrigerator as soon as possible. If the shrimp is going to accompany you during a day full of errands, keep a cooler in the car where you can place the shrimp to make sure it stays cold and does not spoil.

The temperature of most refrigerators is slightly warmer than ideal for storing seafood. Therefore, to ensure maximum freshness and quality, it is important to use special storage methods so as to create the optimal temperature for holding the shrimp.

One of the easiest ways to do this is to place the shrimp in a zip-lock bag in a baking dish layered with ice or icepacks. Place ice or icepacks over the shrimp as well. The baking dish and shrimp should then be placed on the bottom shelf of the refrigerator, which is its coolest area. Replenish ice one or two times per day. Shrimp can be refrigerated for up to two days although it should be purchased as close to being served as possible.

You can extend the shelf life of shrimp by freezing it. To do so, wrap it well in plastic and place it in the coldest part of the freezer where it will keep for about one month.

To defrost shrimp place it in a bowl of cold water or in the refrigerator. Do not thaw the shrimp at room temperature or in a microwave since this can lead to a loss of moisture and nutrients, and can increase risk of contamination.

How to Enjoy

A Few Quick Serving Ideas

- Combine chopped shrimp with chopped scallions, tomatoes, diced chili peppers, garlic, lemon juice, and a little olive oil. Season to taste and serve this fragrant shrimp salad on a bed of romaine lettuce.
- Serve cold cooked shrimp with salsa dip.
- Cut up cooked shrimp and add it to vegetable soups.
- Make a quick, easy and healthy version of pasta putanesca. Add cooked shrimp to spicy pasta sauce and serve over whole wheat noodles.

See some of our favorite Recipes

Safety

General Environmental Concerns

Contamination of ocean waters, overfishing of fish and shellfish species, quality of fish farming practices, potential detrimental effects of certain fishing methods on wildlife, and risk of exposure to fish contaminants (especially mercury) have become individual concerns for many consumers. (These concerns are not limited to shrimp, but extend to all seafood.) Luckily, two organizations in the U.S. have worked to evaluate all the issues listed above, and offer practical recommendations for making fish choices in light of these concerns. We encourage you to make use of the resources provided by both of these organizations. The first organization is the Monterey Bay Seafood Watch (www.seafoodwatch.org)

You can find practical recommendation for 65 different types of fish thanks to the work of Monterey Bay, as well as Best Choices, Good Alternatives, and Choices to Avoid. You can also download seafood guides specific to your region of the United States and a mobile app providing you with this information. The Monterey Bay Seafood Watch program is associated with the Monterey Bay Aquarium in Monterey Bay, California and run by the not-for-profit Monterey Bay Aquarium Foundation.

The second organization is the National Ocean and Atmospheric Administration Fish Watch (http://www.fishwatch.gov/). The National Ocean and Atmospheric Administration (NOAA) is a federal agency in Washington, D.C. that has used its FishWatch website to create educational, user-friendly profiles of over 100 fish and shellfish, with up-to-date information about fishing rate, habitat impacts, population, bycatch, species science, nutrient content, and marketplace availability. In comparison with the Monterey Bay Seafood Watch, the FishWatch site is more educational in nature, and is focuses on the providing of information that can be used to make informed seafood choices.

Shrimp and Food Allergies

Crustacean shellfish, such as shrimp, are among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions.

Shrimp and Sulfites

Some adverse reactions to shrimp may not involve actual allergy but rather reaction to sulfite preservatives used to protect the shelf life of the shrimp. For details about possible adverse reactions to sulfites, please see our article An Overview of Adverse Food Reactions

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Shrimp, large, steamed
4.00 oz
113.40 grams

Calories: 135
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
selenium	56.13 mcg	102	13.6	excellent
vitamin B12	1.88 mcg	78	10.4	excellent
protein	25.83 g	52	6.9	very good
phosphorus	347.00 mg	50	6.6	very good
choline	153.54 mg	36	4.8	very good
copper	0.29 mg	32	4.3	very good
iodine	46.00 mcg	31	4.1	very good
vitamin B3	3.04 mg	19	2.5	good
zinc	1.85 mg	17	2.2	good
vitamin E	2.49 mg (ATE)	17	2.2	good
vitamin B6	0.27 mg	16	2.1	good
omega-3 fats	0.34 g	14	1.9	good
pantothenic acid	0.59 mg	12	1.6	good
vitamin A	102.06 mcg RAE	11	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Tuna

What's New and Beneficial about Tuna

- Researchers have recently discovered that tuna contains the mineral selenium in an unusual form called selenoneine. This form of selenium plays an important role in the health of the fish by serving as an antioxidant and protecting the fish's red blood cells from free radical damage. Interestingly, it is also able to bind together with mercury compounds in the fish's body (including methyl mercury, or MeHg) and lower their risk of mercury-related problems. Because there are approximately 2-3 milligrams of selenoneine in a 4-ounce serving of tuna, we are likely to get some of this same antioxidant protection when we eat tuna. Equally interesting, perhaps tuna will turn out to be a fish that—even when contaminated with mercury—might pose less of a mercury risk than might otherwise be expected due to the presence of selenoneine. There is some evidence to show that lower concentrations of both selenoneine and selenium itself may be present in fresh tuna that lacks its characteristic reddish color and is more watery and softer in texture at the time of purchase. However, further research is needed to determine exactly how the selenium content of tuna is related both to its appearance and also to its potential mercury risk.
- In a much-discussed recent study about fish intake and cardiovascular disease, researchers have uncovered a very interesting trend involving tuna. Over 15,000 U.S. men and women participated in this 15+ year study, and their intake of fish—including canned tuna, darker oily fish like salmon and sardines, lighter non-oily fish like cod, and shellfish like shrimp and lobster—was compared with their likelihood of experiencing a specific type of cardiovascular problem called atrial fibrillation (AF). In AF, electrical impulses within the heart become irregular. In the broadest dietary context, total consumption of fish did not help these participants lower their risk of AF—even if fish were eaten more than twice per week. However, researchers did find risk of AF to be reduced when a specific combination of fish—namely, canned tuna and oily fish like salmon—was eaten more than twice per week. (The average serving size here was 3-4 ounces.) Interestingly, this specific fish combination was more closely related to decreased risk of AF than the total amount of omega-3 fatty acids provided by the fish. While we cannot be sure about the reasons for benefits from this specific combination of fish, the contribution of tuna to decreased risk of this cardiovascular-related problem seems important and worth careful future investigation.
- During the preparation of tuna for canning, whole fish are often steamed for a period of hours, and during this process, a watery liquid (called cooking juice) is created that frequently gets discarded as waste by tuna manufacturers. In recent studies, however, scientists have examined the nutrient composition of this cooking juice and determined that small protein fragments—called peptides—are present in the cooking juice and that they possess strong antioxidant properties. The antioxidant properties of these tuna peptides include the ability to protect cell membranes from oxygen-related damage (a process called lipid peroxidation). While the manufacturing of canned tuna is obviously a very different and much more lengthy process than the very short duration cooking methods that you would be using to steam, sear, or broil tuna in your own kitchen, it is still very likely that your at-home cooking methods for preparing fresh tuna will result in creation of some of these same beneficial antioxidant peptides.

Tuna, yellowfin fillet, baked
4.00 oz
(113.40 grams)

Calories: 147
GI: very low

Nutrient	DRI/DV
selenium	223%
vitamin B3	156%
vitamin B12	111%
vitamin B6	69%
protein	66%
phosphorus	54%
vitamin D	23%
choline	21%
potassium	17%
iodine	15%
vitamin B1	13%
magnesium	12%
vitamin B2	12%

Health Benefits

Anti-Inflammatory and Antioxidant Benefits

No single category of nutrient has been more clearly determined to have anti-inflammatory health benefits than omega-3 fatty acids, and tuna is equally well-established as an important food source of omega-3s. In an average 5-ounce can of tuna, you are likely to get about 7-28 milligrams of EPA (eicosapentaenoic acid) and 140-850 milligrams of DHA (docosahexaenoic acid). Both EPA and DHA are critical omega-3 fatty acids for proper regulation of the body's inflammatory system and prevention of excessive inflammation. Generally speaking, you're likely to get more omega-3s from canned albacore than from canned "light" tuna made from other species of tuna like skipjack (but also at times including yellowfin, tongol, or bigeye). But you are also likely to get more mercury from canned albacore as well because albacore are typically larger and older, having had more opportunity to accumulate mercury from contaminated ocean waters.

Researchers in the Department of Marine Science at Coastal Carolina University in Conway, South Carolina have recently taken a very interesting approach to this controversial trade-off between the beneficial, anti-inflammatory omega-3s found in fish and their undesirable contamination with mercury. These researchers reviewed nutritional studies on the anti-inflammatory benefits of omega-3s to arrive at a daily intake recommendation of 500 milligrams for EPA-plus-DHA (combined). Next, they estimated how many servings of fish would be required to meet this recommended level. In the case of canned albacore tuna, for example, they estimated that a person would need to consume 9 servings per month (with 7 ounces per serving) to provide an average daily amount of 500 milligrams of EPA-plus-DHA.

Using a similar type of logic, they then took the National Academy of Sciences (NAS) recommended safe dose level for mercury, calculated a safe daily intake level of mercury from fish of 6.8 micrograms and estimated how many daily fish servings a person could consume without going over this 6.8 microgram limit. In the case of canned albacore tuna, they determined that only 3 servings of canned albacore tuna could be eaten each month if a person wanted to stay below the 6.8 microgram daily limit for mercury. Based on this logic, they concluded that canned albacore tuna did not provide a good trade-off between omega-3s and mercury since a person would need 9 servings per month to meet the omega-3 recommendation, but would actually have to stop after 3 servings in order to stay below the mercury limit. In fact, these researchers did not find any type of tuna (not only canned albacore, but also canned light tuna and wild ahi tuna) that was able to meet the omega-3 recommendation without exceeding the mercury limit. They did find other fish, however, that provided the desired amount of omega-3s without going over the mercury limit. These other fish included salmon, trout, shrimp and tilapia.

While we admire the creativity and logic used by these researchers to evaluate the trade-off between omega-3s and mercury in fish, we take a somewhat different approach while using their same logic. Like these marine science researchers, we think it's important for individuals to minimize their food exposure to mercury, and we like the idea of staying below the NSA limit. However, we also believe there is no reason for a person to depend exclusively on fish for their omega-3s, nor do we believe that all of a person's omega-3s must be provided in the form of EPA and DHA.

Many foods can provide small amounts of omega-3s, and other forms of omega-3s (like alpha-linolenic acid, found in many plant foods) also help to provide us with anti-inflammatory benefits. For these reasons, we believe that individuals have the flexibility to enjoy tuna and other types of fish by focusing on their overall diet and making sure they get plenty of anti-inflammatory omega-3s from all of their foods combined, while still staying below the mercury limit in their overall diet. From a practical standpoint, this approach means including a variety of omega-3 foods in the overall diet, emphasizing fish that are lower in mercury contamination, and including higher mercury fish on a more limited basis. Wild-caught Alaskan salmon, for example, could be eaten during the same week as tuna to help avoid excessive mercury exposure while still reaping the anti-inflammatory benefits of omega-3s.

While small amounts of antioxidant nutrients like vitamin C, manganese, and zinc are provided by tuna, it is unusually rich in one particular antioxidant mineral, namely, selenium. This antioxidant is not only concentrated in tuna but is also present in an unusual form called selenoneine. Selenoneine is especially helpful to the tuna as a nutrient for protecting their red blood cells from free radical damage. Interestingly, it is also able to bind together with mercury compounds in the fish's body (including methylmercury, or MeHg) and lower their risk of mercury-related problems. Because there are approximately 2-3 milligrams of selenoneine in a 4-ounce serving of tuna, we are likely to get some of this same antioxidant protection whenever we eat tuna. Equally interesting, tuna may turn out to be a fish that - even when contaminated with mercury—might pose less of a mercury risk to humans than might otherwise be expected due to the presence of selenium in this special form of selenoneine.

When you steam or sear or broil fresh tuna at home, this cooking process may also result in some special antioxidant benefits. These benefits are related to the presence of small protein fragments—called peptides—that may get formed during the cooking process when proteins in the tuna get broken down. Recent studies have shown that some of the protein breakdown products in tuna have strong antioxidant properties, including the ability to protect cell membranes from oxygen-related damage (a process called lipid peroxidation).

Other Health Benefits

When researchers study the overall benefits of omega-3 containing fish in a regular diet plan, they almost always find cardiovascular benefits to emerge at the top of the health benefit list. Researchers know, for example, that consumption of omega-3 fish can increase the presence of omega-3s in the membranes of red blood cells as well as cells along the blood vessel linings. This increased level of omega-3s in the circulatory system is associated with better regulation of blood pressure and lower risk of blood vessel "clogging." Approximately 2-3 servings of omega-3 fish per week over the course of 3-4 months has been shown to provide these cardiovascular benefits, and in some studies, tuna has specifically been shown to raise bloodstream levels of omega-3s as described above.

In this area of cardiovascular benefits, some studies have also shown tuna to be a potentially helpful food in lowering risk of a heart-related problem called atrial fibrillation (AF). AF is a condition involving irregular electrical impulses within the heart. Intake of three or more servings of tuna and/or oily fish (like sardines or salmon) per week has been associated with a 15-30% decreased risk of AF in some studies. The common link in these studies between tuna and oily fish might obviously involve the omega-3 fats provided by these fish. At the same time, however, both tuna and oily fish like salmon and sardines provide significant amounts of vitamin D (and rank in our top four WHFoods for vitamin D richness) and they also rank as our top three foods for vitamin B12. These areas of vitamin richness might also play an important role in potential cardiovascular benefits associated with tuna intake. Finally, not to be left out of potential cardiovascular benefits provided by tuna are its nutrient contributions in the mineral department that extend beyond its selenium richness. Tuna is a good source of both magnesium and potassium, and each of these minerals are important contributors to healthy blood flow and heart function, especially with respect to well-regulated blood pressure.

Health benefits from tuna may also exist in the area of cancer risk. Here the research is somewhat mixed, for several reasons. First, there is very little research specific to tuna. Most of the large-scale studies have looked at fish intake overall, or fatty versus nonfatty fish, rather than tuna per se. Second, not all researchers classify tuna in the same way. Some classify it as a fatty fish, yet other classify it as a white fish (and non-fatty). Part of the reason for this inconsistency involves widespread consumption of canned albacore tuna, which typically contains less than 3 grams of total fat per ounce. In the area of colon cancer, there is clear evidence that increased intake of omega-3 fats from fish as a group can lower risk of this cancer type. While this fish group has almost always contained tuna in large-scale research studies, we're not aware of studies in which tuna has not been analyzed independently as a unique fish for helping lower colon cancer risk. In the areas of prostate cancer and renal cancer, there is also some evidence of decreased risk from consumption of fish containing omega-3s, although the findings seem to be more mixed for these cancer types, with some studies failing to show decreased risk.

It's worth adding that despite the relative absence of evidence regarding specific intake of tuna and cancer risk, there is a large amount of research connecting decreased overall cancer risk with increased intake of omega-3 fatty acids in the overall diet.

From an overall nutritional standpoint, tuna is more diverse in its nutrient content than many people would suspect. It's an excellent source of vitamin B3 (niacin), vitamin B6 (pyridoxine), and vitamin B12 (cobalamin), as well as a good source of vitamin B1, vitamin B2, and choline. In combination, the result is a wide variety of B-complex vitamins all supplied in valuable amounts by tuna. Tuna is also a very good source of the mineral phosphorus and a good source of the minerals potassium, iodine, and magnesium. Of course, because of its muscle content, tuna is an excellent source of protein, providing two thirds of the Daily Value (DV) in one 4-ounce serving. In fact, tuna is our top protein source at WHFoods. This nutrient diversity in tuna would be expected to provide support for other body systems not mentioned above, including energy metabolism and blood sugar regulation.

Description

The tuna family is a diverse family of fish. Some tuna are classified as "pelagic" fish that live relatively close the surface or in water columns that extend downward for several hundred meters at most. Others are classified as "midwater" fish that can be found at depths up to 600 meters. Tuna swim in most of the world's oceans. For example, there are six major stocks of albacore tuna, in the North Atlantic, South Atlantic, Indian Ocean, Mediterranean Sea, north Pacific and south Pacific.

This family of fish ranges widely in size. Some tuna—like bullet tuna—average about 1 foot in length. Other tuna—like Atlantic Bluefin—average over 6 feet in length and have been known to reach a size of 15 feet. Most tuna migrate over many miles of water (for example, some regularly cross the Atlantic or Pacific Oceans, over a distance of many thousand miles). While some smaller species of tuna live no longer than 3-5 years, it is not unusual for larger species like bluefin to live upwards of 20 years. All tuna belong to the scientific family called *Scombridae*, which also includes mackerel and bonito.

Among the most commercially popular of all tuna species are the following.

Albacore (*Thunnus alalunga*)

Albacore are a moderately sized and moderately long-lived species of tuna, with a common length of 3-4 feet, common weight of 15-45 lbs., and an average lifespan of 9-12 years. Albacore tuna can be labeled as "white meat" tuna when canned and has become a popular canned variety in the U.S.

Bigeye (*Thunnus obesus*)

While smaller and shorter-lived than bluefin (on average), bigeye are still considered a large and long-lived species of tuna, able to reach lengths of eight feet or more and often averaging five to six feet. Bigeye are sometimes sold under their Hawaiian name, "ahi." Along with yellowfin and bluefin, some bigeye are also used in sushi and sashimi and labeled referred to as "maguro."

Blackfin (*Thunnus atlanticus*)

Blackfin tuna belong to the yellowfin subgroup of tuna but have not become a commercially important species, unlike their yellowfin counterparts. Blackfin are relatively small in size, averaging between 1-3 feet in length and often 10-20 lbs.

Bluefin (*Thunnus maccoyii*—Southern Bluefin; *Thunnus orientalis*—Pacific Bluefin; and *Thunnus thynnus*—Atlantic Bluefin)

Bluefin are the largest of the commercial tuna species and can reach weights exceeding 1,000 pounds and lengths of nearly 15 feet. It is also common for bluefin to have a lifespan of 20 years, and in some cases, nearly twice that long. Some bluefin swim from the Gulf of Mexico (where they are born) across the entire Atlantic Ocean, live along the European coast of the Atlantic, and then eventually swim back to the Gulf of Mexico to reproduce. When swimming, their top water speeds can reach 40-45 miles per hour.

Bluefin are a popular species of tuna in preparation of sushi and sashimi, where they are often referred to as "hon maguro." You can also find bluefin tuna being referred to as "toro" (tuna belly) when served as sushi. Due to their larger size and longevity, bluefin also average higher mercury concentrations than most other species of tuna.

Bluefin are also some of the most endangered tuna species. The International Union for Conservation of Nature (IUCN) in Cambridge, UK lists Southern bluefin as "critically endangered" and Atlantic Bluefin as "endangered."

Skipjack (*Katsuwonus pelamis*)

Skipjack is the species of tuna that you are most likely to find in a can of "light" tuna. They're a relatively small species of tuna, often weighing between five to six pounds and averaging one to two feet in length. Skipjack are also shorter lived, with a lifespan of two to three years. This combination of lifestyle circumstances also tends to make skipjack a tuna species that is lower in mercury accumulation.

Skipjack is most often sold as canned light tuna and is the most common species found in tuna cans. It's also sold fresh or frozen.

When prepared for sushi, skipjack tuna is sometimes referred to as "bonito" or "katsuo," and skipjack tuna is often used similarly to yellowfin tuna in preparation of sashimi. Some segments of the sashimi market prefer skipjack and use it interchangeably with yellowfin tuna in grilled or fried preparations.

Tongol (*Thunnus tonggol*)

Tongol (also called longtail) has become a popular alternative species of tuna in the canned "light" tuna market. Unlike many of its fellow tuna, tongol are less migratory, seasonal, and found primarily in the Indian and Western Pacific oceans. Virtually all commercially available tongol come from the coastlines of Malaysia, Indonesia, Thailand, and Iran (where the Indian Ocean becomes the Arabian Sea). Tongol are relatively small in size, averaging approximately 10-12 pounds and ranging from 1-3 feet in length. The overall lifestyle and size of tongol also make them lower in mercury accumulation in the limited data that we have seen. Although most canned light tuna features skipjack as its primary species, it is not unusual to find "light" canned tuna that include tongol.

Yellowfin (*Thunnus albacares*)

Yellowfin are moderate-to-large sized tuna, ranging widely in size from one to two feet to as large as five to six feet, and in some cases, even longer. Smaller yellowfin average 10-12 pounds in weight, but larger yellowfin will average much more, in the range of 40-60 pounds (and in some cases, even more). Yellowfin are relatively fast growing and have an average lifespan of four to eight years. Their variable size also makes them variable in mercury accumulation, but most of the data we have seen on yellowfin show their mercury concentrations to fall at the moderate level.

Other Species of Tuna

Other species of tuna include bullet tuna (*Auxis rochei*), dogtooth tuna (*Gymnosarda unicolor*), slender tuna (*Allothunnus fallai*), frigate tuna (*Auxis thazard*), and kawakawa (*Euthynnus affinis*).

History

The evolution of ocean fish shows the emergence of tuna to have occurred approximately 45 millions years ago—long before humans were around to go fishing for them! Tuna swim in all of the earth's oceans (except for oceans at the North and South Poles), including all parts of the Atlantic, Pacific, and Indian Oceans, as well as the Mediterranean Sea. There is evidence of Phoenician trap fisheries for tuna as early as 2000 BC.

For most of human history, fishing for tuna has been a small-scale regional and seasonal practice. The unique migratory patterns of tuna made small coastal fisheries for tuna the rule rather than the exception. Beginning in the 1940's and 1950's, however, industrial fishing for tuna started to become more and more widespread, with greatly expanded tonnage and offshore distances. Tuna—and particularly certain species, like bluefin—have been overfished on a global basis and Thailand, Ecuador, the Philippines, Spain, China, Mauritius, and Indonesia were the countries exporting the greatest volume of canned and processed tuna in 2014. Among species produced, skipjack led all other species, with yellowfin ranking second. Between 50-75 countries regularly participate in the commercial tuna production, most of which takes place in the Atlantic, Pacific, and Indian Oceans. In comparison to other fish, tuna has yet to be extensively farmed, even though there is increasing commercial investigation of tuna farming in various regions throughout the world, including the Mediterranean. The use of net pens in an open sea environment to contain and raise bluefin tuna has been experimented with in this region (along with other regions worldwide). However, few scientists believe that net pen farming can help to compensate long-term for overfishing of tuna, or alleviation of problems related to their endangered status.

How to Select and Store

Tuna is sold in many different forms. It is available fresh as steaks, fillets, or pieces. Tuna is probably best known in its canned form.

Just as with any seafood, it is best to purchase fresh tuna from a store that has a good reputation for having a frequent supply of fresh fish. Get to know a fishmonger (the person who sells the fish) at the store, so you can have a trusted resource from whom you can purchase your fish with confidence.

Fresh whole tuna should be displayed buried in ice, while fillets and steaks should be placed on top of the ice. Try to avoid purchasing tuna that has dry or brown spots.

Smell is a good indicator of freshness. Since a slightly "off" smell cannot be detected through plastic, if you have the option, purchase displayed fish as opposed to pieces that are prepackaged. Once the fishmonger wraps and hands you the fish that you have selected, smell it through the paper wrapping and return it if it has a truly strong fishy odor.

Canned tuna is available either solid or in chunks, and is packaged in oil, broth or water. Although the tuna packed in oil is usually the moistest, it also has the highest fat content, and the oils in which it is packed are high in omega-6 fats. Since omega-6s and omega-3s compete for the same enzymes that activate them for use in the body, and most Americans already consume too many omega-6 fats in comparison to omega-3s, it is best to purchase tuna packed in water or broth. Oftentimes, canned tunas do not distinguish which specific species was used except to note that it is either light tuna (bluefin or yellowfin) or white tuna (usually albacore).

One final note about tuna selection: at present, the U.S. Department of Agriculture National Organic Program has yet to implement organic certification standards for seafood, including tuna. In the absence of organic certification, you may want to obtain more additional information on salmon than you otherwise might do with certified organic foods, and for this reason, our Individual Concerns section provides you with links to additional websites that provide high-quality and straightforward information about seafood choices (including salmon).

When storing all types of fresh seafood, including tuna, it is important to keep them cold since fish spoils quickly and is very sensitive to temperature. Therefore, after purchasing tuna or other fish refrigerate it as soon as possible. If the fish is going to accompany you during a day full of errands, keep a cooler in the car where you can place your tuna to make sure it stays cold and does not spoil.

The temperature of most refrigerators is slightly warmer than ideal for storing fish. To ensure maximum freshness and quality, it is important to use special storage methods to create the optimal temperature for holding the fish. One of the easiest ways to do this is to place fish, which has been well wrapped, in a baking dish filled with ice. The baking dish and fish should then be placed on the bottom shelf of the refrigerator, which is its coolest area. Replenish the ice one or two times per day.

The length of time that tuna can stay fresh stored this way depends upon how fresh it is, i.e. when it was caught. But in general, about two days is the longest time period that we recommend refrigerating fresh fish on ice. After two days, we recommend freezing the fish if you will not be cooking it. To freeze, wrap it well in plastic and place it in the coldest part of the freezer where it will keep for up to two or three weeks.

All of these selection and storage steps for tuna are especially important due to special risk of histamine formation in tuna. Adverse reactions to histamine in tuna are often referred to as "scombrotoxic poisoning" since tuna belong to Scombridae family of fish. Failure to keep fresh tuna well chilled at refrigerator temperatures prior to cooking can result in increased histamine content and greater risk of adverse reaction. So can improper handling of canned tuna, in which a can is opened and allowed to sit at room temperature after being opened yet not consumed for several hours. The possibility of unwanted histamine formation in tuna makes it especially important for you to use care in the selection and storage of this food.

How to Enjoy

A Few Quick Serving Ideas

- Tuna is a featured ingredient in the classic French dish, Salad Nicoise, which pairs tuna fish with steamed green beans and potatoes.
- The sky's the limit when making tuna salad since so many different ingredients nicely complement tuna's mild flavor. Some of our favorite tuna salad ingredients include olives, chili peppers, leeks, fennel and walnuts. Try using fresh lemon juice, olive oil, and a little mustard for a healthier way to make a tuna sandwich instead of mayonnaise.
- Stovetop Sear a tuna steak and add it to a salad of mixed greens and vegetables.
- For an Asian-inspired meal with a hot streak, lightly brush a tuna steak with wasabi and soy sauce, and Quick Broil.

For some of our favorite recipes, click Recipes.

Safety

Risk from Mercury Contamination

In 2014, the U.S. Food and Drug Administration (FDA) and U.S. Environmental Protection Agency (EPA) drafted new joint provisional guidelines for tuna consumption by pregnant women, nursing mothers, and young children. These provisional guidelines recommended 2-3 weekly servings of fish by young children on an age-appropriate and calorie-appropriate basis. Similarly, 8-12 ounces of fish representing 2-3 servings per week were recommended for pregnant women and nursing mothers. Simultaneous with this recommendation for regular intake of fish, however, was a recommendation for selection of fish lower in mercury and avoidance of higher mercury fish. With respect to tuna, these provisional guidelines, recommended a limit of 6 ounces of albacore tuna per week for pregnant women and nursing mothers, and preferential selection of light canned tuna when including tuna in weekly fish consumption.

We do not disagree with the logic of the FDA recommendations. Yet, we would also point out that "canned light tuna" may include skipjack, tongol, and yellowfin species and that some yellowfin tuna can be quite high in mercury accumulation. So as a general rule, "canned light tuna" that specify skipjack or tongol may provide you with lower mercury exposure. We would also point out that canned tuna is not the only form of tuna available in the marketplace, and that fresh tuna (including species like skipjack) is available as fresh fish option.

Based on all of the research that we have reviewed, we think it makes sense not only for pregnant women, women of childbearing age who might become pregnant, nursing mothers, and young children to limit their consumption of higher mercury fish, but for everyone who wants to include fish within their meal plan. Accordingly, we do not think it makes sense for you to rely on tuna as a primary seafood source for key nutrients, including omega-3 fats, since all tuna species show some level of mercury contamination in research studies. However, we do think it makes sense for you to treat tuna as a fish that can be enjoyed multiple times per month, especially if you select tuna types with lower mercury risk. As a general rule, we would include both skipjack and tongol tuna in this lower mercury risk category.

In some cases, we would also consider yellowfin to be in the lower mercury risk category, although this species can have widely ranging mercury level due to its widely ranging size and lifestyle. For many people who want to err on the conservative side, it might make sense to avoid yellowfin tuna altogether if you are unable to determine its status as higher or lower in mercury. Because mercury levels in oceans are continuously changing, and because they can vary so greatly from ocean to ocean and even at different water depths within an individual ocean, levels in fish—including tuna—can sometimes be difficult to predict or even determine. One resource you can to follow-up on these levels is mercury and fish information provided by the U.S. Food and Drug Administration (FDA) at this website.

If you are making a decision about tuna consumption and have actual mercury data available like the FDA data above, you can generally regard tuna with mercury levels of 100 ppb or less as being "lower" in mercury, and tuna with mercury levels of 500 ppb or more as being "higher" in mercury.

General Environmental Concerns

Contamination of ocean waters, overfishing of fish and shellfish species, quality of fish farming practices, potential detrimental effects of certain fishing methods on wildlife, and risk of exposure to fish contaminants (especially mercury) have become individual concerns for many consumers. (These concerns are not limited to tuna, but extend to all seafood.) Luckily, two organizations in the U.S. have worked to evaluate all the issues listed above, and offer practical recommendations for making fish choices in light of these concerns. We encourage you to make use of the resources provided by both of these organizations.

The first organization is the Monterey Bay Seafood Watch (www.seafoodwatch.org).

You can find practical recommendation for 65 different types of fish on their website, as well as Best Choices, Good Alternatives, and Choices to Avoid. You can also download seafood guides specific to your region of the United States and a mobile app providing you with this information. The Monterey Bay Seafood Watch program is associated with the Monterey Bay Aquarium in Monterey Bay, California and run by the not-for-profit Monterey Bay Aquarium Foundation.

The second organization is The National Ocean and Atmospheric Administration Fish Watch (http://www.fishwatch.gov/).

The National Ocean and Atmospheric Administration (NOAA) is a federal agency in Washington, D.C. that has used its FishWatch website to create educational, user-friendly profiles of over 100 fish and shellfish, with up-to-date information about fishing rate, habitat impacts, population, bycatch, species science, nutrient content, and marketplace availability. In comparison with the Monterey Bay Seafood Watch, the FishWatch site is more educational in nature, and is focuses on the providing of information that can be used to make informed seafood choices.

Tuna and Food Allergies

Fish, such as tuna, are among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Tuna, yellowfin fillet, baked **4.00 oz** **113.40 grams**			**Calories: 147** **GI: very low**
	DRI/DV	**Nutrient**	**World's Healthiest**

Nutrient	Amount	(%)	Density	Foods Rating
selenium	122.70 mcg	223	27.2	excellent
vitamin B3	25.03 mg	156	19.1	excellent
vitamin B12	2.66 mcg	111	13.5	excellent
vitamin B6	1.18 mg	69	8.5	excellent
protein	33.06 g	66	8.1	excellent
phosphorus	377.62 mg	54	6.6	very good
vitamin D	92.99 IU	23	2.8	good
choline	88.00 mg	21	2.5	good
potassium	597.61 mg	17	2.1	good
iodine	23.00 mcg	15	1.9	good
vitamin B1	0.15 mg	13	1.5	good
vitamin B2	0.16 mg	12	1.5	good
magnesium	47.63 mg	12	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Almonds

Fortunately, the delicately flavored and versatile almond is available throughout the year to make a healthy and tasty addition to both sweet and savory dishes. Although packaged almonds are available year round, they are the freshest in mid-summer, which is when they are at the height of their season.

The almond that we think of as a nut is technically the seed of the fruit of the almond tree, a medium-size tree that bears fragrant pink and white flowers. Like its cousins, the peach, cherry and apricot trees, the almond tree bears fruits with stone-like seeds (or pits) within. The seed of the almond fruit is what we refer to as the almond nut.

Almonds, sliced, raw
0.25 cup
(23.00 grams)

Calories: 132
GI: low

Nutrient	DRI/DV
biotin	49%
vitamin E	40%
manganese	27%
copper	26%
vitamin B2	18%
phosphorus	16%
magnesium	15%
molybdenum	15%
fiber	11%

Health Benefits

Lower LDL-Cholesterol and Reduce Your Risk of Heart Disease

A high-fat food that's good for your health? That's not an oxymoron, its almonds. Almonds are high in monounsaturated fats, the same type of health-promoting fats as are found in olive oil, which have been associated with reduced risk of heart disease. Five large human epidemiological studies, including the Nurses Health Study, the Iowa Health Study, the Adventist Health Study and the Physicians Health Study, all found that nut consumption is linked to a lower risk for heart disease. Researchers who studied data from the Nurses Health Study estimated that substituting nuts for an equivalent amount of carbohydrate in an average diet resulted in a 30% reduction in heart disease risk. Researchers calculated even more impressive risk reduction—45%—when fat from nuts was substituted for saturated fats (found primarily found in meat and dairy products).

A study published in the *British Journal of Nutrition* indicates that when foods independently known to lower cholesterol, such as almonds, are combined in a healthy way of eating, the beneficial effects are additive. In this study of 12 patients with elevated LDL cholesterol levels, a diet containing almonds and other nuts, plant sterols (also found in nuts), soy protein, and soluble fiber (in high amounts in beans, oats, pears) reduced blood levels of all LDL fractions including small dense LDL (the type that most increases risk for cardiovascular disease) with near maximal reductions seen after only 2 weeks.

In addition to their cholesterol-lowering effects, almonds' ability to reduce heart disease risk may also be partly due to the antioxidant action of the vitamin E found in the almonds, as well as to the LDL-lowering effect of almonds' monounsaturated fats. (LDL is the form of cholesterol that has been linked to atherosclerosis and heart disease). When almonds are substituted for more traditional fats in human feeding trials, LDL cholesterol can be reduced from 8 to 12%.

In addition to healthy fats and vitamin E, a quarter-cup of almonds contains 62 mg of magnesium plus 162 mg of potassium.

Magnesium is Nature's own calcium channel blocker. When there is enough magnesium around, veins and arteries breathe a sigh of relief and relax, which lessens resistance and improves the flow of blood, oxygen and nutrients throughout the body. Studies show that a deficiency of magnesium is not only associated with heart attack but that immediately following a heart attack, lack of sufficient magnesium promotes free radical injury to the heart.

Potassium, an important electrolyte involved in nerve transmission and the contraction of all muscles including the heart, is another mineral that is essential for maintaining normal blood pressure and heart function. Almonds promote your cardiovascular health by providing 162 mg of potassium and only 0.2 mg of sodium, making almonds an especially good choice to in protecting against high blood pressure and atherosclerosis.

Almonds Provide Double-Barreled Protection against Diabetes and Cardiovascular Disease

Lessening after-meal surges in blood sugar helps protect against diabetes and cardiovascular disease, most likely by lessening the increase in cholesterol-damaging free radicals that accompanies large elevations in blood sugar. This is one reason why low- glycemic index diets result in lower risk of diabetes and heart disease.

Almonds appear to not only decrease after-meal rises in blood sugar, but also provide antioxidants to mop up the smaller amounts of free radicals that still result. (Jenkins DJ, Kendall CW, *Journal of Nutrition*)

Researchers fed 15 healthy subjects 5 meals providing a comparable amount of carbohydrate, fat and protein: 3 test meals (almonds and bread, parboiled rice, and instant mashed potatoes) and 2 bread control meals. Blood samples, taken before each meal and 4 hours afterwards, showed levels of protective antioxidants increased after the almond meal, but decreased after the other meals. And not only did the almond meal increase antioxidant levels, but unlike the other foods, almonds also lowered the rise in blood sugar and insulin seen after eating.

Further research shows that eating almonds along with a high glycemic index food significantly lowers the glycemic index of the meal and lessens the rise in blood sugar after eating. (Jones AR, Kendall CW, *Metabolism*)

In this study, after an overnight 10-12 hour fast, 9 healthy volunteers were randomly fed 3 test meals and 2 white bread (high glycemic) control meals on separate days. Each meal contained 50 grams of carbohydrate from white bread eaten either alone or in combination with 1, 2, or 3 ounces of almonds. To check subjects' rise in blood sugar, blood samples were taken for glucose analysis immediately after eating, and at 15, 30, 45, 60, 90 and 120 minutes.

Eating almonds reduced the glycemic index (GI) of the meal and subjects' rise in blood sugar in a dose-dependent manner—the more almonds consumed, the lower the meal's GI and the less the rise in subjects' blood sugar after eating.

When one-ounce of almonds was eaten along with white bread, the GI of the meal (105.8) was comparable to eating white bread alone, but when two ounces of almonds were consumed with the white bread, the GI dropped to 63, and when 3 ounces of almonds were eaten, the GI was only 45.2—less than half the GI of the white bread only meal.

Subjects' blood sugar rose 2.8 mmol/L after eating only white bread. When one ounce of almonds was eaten with the bread, blood sugar rose 2.2 mmol/L. Eating two ounces of almonds with the bread resulted in a rise in blood sugar of 2.0 mmol/L, and eating three ounces of almonds caused blood sugar to rise only 1.6 mmol/L—less than half the rise seen after eating white bread alone.

Practical Tips: Don't just enjoy almonds as a between-meal snack. Spread a little almond butter on your toast or down the center of a stalk of celery. Add a handful of lightly roasted almonds to your salad or chop and use as a topping for pasta, steamed or healthy sauteed vegetables. When eating foods with a higher glycemic index, including almonds in the meal can help keep your blood sugar under control.

Crazy about Your Heart? Go Nuts

Other nuts appear to be cardio-protective as well. Research published in the *British Journal of Nutrition* (Blomhoff R, Carlsen MH), which identified several nuts among plant foods with the highest total antioxidant content, suggests nut's high antioxidant content may be key.

Walnuts, pecans and chestnuts have the highest antioxidant content of the tree nuts, with walnuts delivering more than 20 mmol antioxidants per 3 ounces (100 grams). Peanuts (although technically, a legume) also contribute significantly to our dietary intake of antioxidants.

Nuts' high antioxidant content helps explain results seen in the Iowa Women's Health Study in which risk of death from cardiovascular and coronary heart diseases showed strong and consistent reductions with increasing nut/peanut butter consumption. Total death rates decreased 11% and 19% for nut/peanut butter intake once per week and 1-4 times per week, respectively.

Even more impressive were the results of a review study of the evidence linking nuts and lower risk of coronary heart disease, also published in the *British Journal of Nutrition*. (Kelly JH, Sabate J.) In this study, researchers looked at four large prospective epidemiological studies—the Adventist Health Study, Iowa Women's Study, Nurses' Health Study and the

Physician's Health Study. When evidence from all four studies was combined, subjects consuming nuts at least 4 times a week showed a 37% reduced risk of coronary heart disease compared to those who never or seldom ate nuts. Each additional serving of nuts per week was associated with an average 8.3% reduced risk of coronary heart disease.

Practical Tip: To lower your risk of cardiovascular and coronary heart disease, enjoy a handful of nuts or tablespoon of nut butter at least 4 times a week.

Almonds Surpass Whole Wheat Muffins for Improving Blood Fats

Even individuals who are experiencing problems with their blood fat levels may not automatically need to shy away from high-fat food snacks like almonds. Researchers at the University of Toronto, Canada have shown that a 2.5 ounce snack of almonds each day can do a better job in lowering blood LDL and raising blood HDL than a whole wheat muffin having the same amount of fat and fiber as almonds. They also found that markers of antioxidant status in the body could be improved with the incorporation of almond snacks. It was the many phytonutrients (especially flavonoids) found in almonds that were believed to account for some of these special almond benefits.

Whole Almonds (with Skins) Provide Most Heart Healthy Benefits

New research on almonds adds to the growing evidence that eating whole foods is the best way to promote optimal health.

The flavonoids found in almond skins team up with the vitamin E found in their meat to more than double the antioxidant punch either delivers when administered separately, shows a study published in the *Journal of Nutrition*.

Twenty potent antioxidant flavonoids were identified in almond skins in this study, some of which are well known as major contributors to the health benefits derived from other foods, such as the catechins found in green tea, and naringenin, which is found in grapefruit.

"We have identified a unique combination of flavonoids in almonds," said Jeffrey Blumberg, Ph.D., senior scientist and director of the Antioxidants Research Laboratory at Tufts University. "Further blood tests demonstrated that eating almonds with their skins significantly increases both flavonoids and vitamin E in the body. This could have significant health implications, especially as people age."

Blumberg's team tested the effects of almond skin's flavonoids alone and then in combination with the vitamin E found in almond meat on blood samples containing LDL cholesterol. While almond skin flavonoids alone enhanced LDL's resistance to oxidation by 18%, when almond meat's vitamin E was added, LDL's resistance to oxidation was extended by 52.5%!

"The synergy between the flavonoids and vitamin E in almonds demonstrates how the nutrients in whole foods such as almonds can impact health," says Dr. Blumberg.

Two other studies have recently confirmed the heart-healthy benefits offered by whole almonds:

A study published in the *American Journal of Clinical Nutrition*, which found that, as part of a diet rich in heart healthy foods such as soy, viscous fiber and plant sterols, almonds can reduce cholesterol levels as much as first generation statin drugs.

And a second study by the same research team, published in the *European Journal of Clinical Nutrition*, and found that, as part of the same heart healthy eating plan, almonds can reduce C-reactive protein, a marker of artery-damaging inflammation, as much as statin drugs. Need more reasons to make almonds a staple in your healthy way of eating? Ounce for ounce, almonds are the one of the most nutritionally dense nuts. As well as providing an array of powerful flavonoids, almonds are among the richest sources of vitamin E in the diet.

Almond's Healthy Fats May Help You Lose Weight

A study published in the *International Journal of Obesity and Related Metabolic Disorders* that included 65 overweight and obese adults suggests that an almond-enriched low calorie diet (which is high in monounsaturated fats) can help overweight individuals shed pounds more effectively than a low calorie diet high in complex carbohydrates. Those on the almond-enriched low calorie diet consumed 39% of their calories in the form of fat, 25% of which was monounsaturated fat. In contrast, those on the low calorie diet high in complex carbohydrates consumed only 18% of their calories as fat, of which 5% was monounsaturated fat, while 53% of their calories were derived from carbohydrate. Both diets supplied the same number of calories and equivalent amounts of protein. After 6 months, those on the almond-enriched diet had greater reductions in weight (-18 vs. -11%), their waistlines (-14 vs. -9%), body fat (-30 vs. -20%), total body water (-8 vs. -1%), and systolic blood pressure (-11 vs. 0%). Those eating almonds experienced a 62% greater reduction in their weight/BMI (body mass index), 50% greater reduction in waist circumference, and 56% greater reduction in body fat compared to those on the low calorie high carbohydrate diet! Among those subjects who had type 1 diabetes, diabetes medication reductions were sustained or further reduced in 96% of those on the almond-enriched diet versus in 50% of those on the complex carbohydrate diet.

Eating Nuts *Lowers* Risk of Weight Gain

Although nuts are known to provide a variety of cardio-protective benefits, many avoid them for fear of weight gain. A prospective study published in the journal *Obesity* shows such fears are groundless. In fact, people who ate nuts at least twice a week were much *less* likely to gain weight than those who almost never ate nuts.

The 28-month study involving 8,865 adult men and women in Spain, found that participants who ate nuts at least two times per week were 31% less likely to gain weight than were participants who never or almost never ate nuts.

And, among the study participants who gained weight, those who never or almost never ate nuts gained more (an average of 424 g more) than those who ate nuts at least twice weekly.

Study authors concluded, "Frequent nut consumption was associated with a reduced risk of weight gain (5 kg or more). These results support the recommendation of nut consumption as an important component of a cardioprotective diet and also allay fears of possible weight gain."

Practical Tip: Don't let concerns about gaining weight prevent you from enjoying the delicious taste and many health benefits of nuts!

- Spread some nut butter on your morning toast or bagel.
- Remember how many great childhood lunches involved a peanut butter and jelly sandwich? Upgrade that lunchbox favorite by spreading organic peanut butter and concord grape jelly on whole wheat bread.
- Fill a celery stick with nut butter for an afternoon pick-me-up.
- Sprinkle a handful of nuts over your morning cereal, lunchtime salad, dinner's steamed vegetables.
- Or just enjoy a handful of lightly roasted nuts as a healthy snack.

Daily Consumption of Almonds May Help You Eat a Healthier Diet

If you've been reluctant to add almonds to your diet because of their high calorie count, a study published in the *British Journal of Nutrition* may help convince you to give these delicious, nutrient-dense nuts a try.

In this study, the normal eating patterns of 43 men and 38 women were followed for 6 months. Then they were told to eat approximately 2 ounces or one-quarter cup of almonds daily but were given no other instructions about changing their diet, and followed for an additional 6 months. By the end of the study, a number of very beneficial changes were seen to naturally occur.

While eating almonds, study participants' intake of health-promoting monounsaturated fatty acids, polyunsaturated fatty acids, fiber, vegetable protein, vitamin E, copper and magnesium significantly increased by 42, 24, 12, 19, 66, 15, and 23%, respectively.

At the same time, their intake of trans fatty acids, animal protein, sodium, cholesterol and sugars significantly decreased by 14, 9, 21, 17 and 13%, respectively. Both sets of changes in nutrient intake closely match the dietary recommendations known to prevent cardiovascular and other chronic diseases.

Manganese, Copper & Riboflavin—More Help with Energy Production

Almonds are a very good source of manganese and copper, two trace minerals that are essential cofactors of a key oxidative enzyme called *superoxide dismutase*. Superoxide dismutase disarms free radicals produced within the mitochondria (the energy production factories within our cells), thus keeping our energy flowing. Fortunately, Mother Nature supplies both mineral cofactors in almonds. Riboflavin (vitamin B2) also plays at least two important roles in the body's energy production. When active in energy production pathways, riboflavin takes the form of flavin adenine dinucleotide (FAD) or flavin mononucleotide (FMN). In these forms, riboflavin attaches to protein enzymes called *flavoproteins* that allow oxygen-based energy production to occur.

Flavoproteins are found throughout the body, particularly in locations where oxygen-based energy production is constantly needed, such as the heart and other muscles. Riboflavin's other role in energy production is protective.

The oxygen-containing molecules the body uses to produce energy can be highly reactive and can inadvertently cause damage to the mitochondria and even the cells themselves. In the mitochondria, such damage is largely prevented by a small, protein-like molecule called *glutathione*. Like many "antioxidant" molecules, glutathione must be constantly recycled, and it is vitamin B2 that allows this recycling to take place. (Technically, vitamin B2 is a cofactor for the enzyme glutathione reductase that reduces the oxidized form of glutathione back to its reduced version.)

Help Prevent Gallstones

Twenty years of dietary data collected on over 80,000 women from the Nurses' Health Study shows that women who eat least 1 ounce of nuts, peanuts or peanut butter each week have a 25% lower risk of developing gallstones. Since 1 ounce is only 28.6 nuts or about 2 tablespoons of nut butter, preventing gallbladder disease may be as easy as having a handful of almonds as an afternoon pick me up, tossing some almonds on your oatmeal or salad or packing one almond butter and jelly sandwich (be sure to use whole wheat bread for its fiber, vitamins and minerals) for lunch each week.

Description

The almond that we think of as a nut is technically the seed of the fruit of the almond tree, a glorious medium-size tree that bears fragrant pink and white flowers. Like its cousins, the peach, cherry and apricot trees, the almond tree bears fruits with stone-like seeds (or pits) within. The seed of the almond fruit is what we refer to as the almond nut.

Almonds are off-white in color, covered by a thin brownish skin, and encased in a hard shell. Almonds are classified into two categories: sweet (*Prunus amygdalu var. dulcis*) and bitter (*Prunus amygdalu var. amara*).

Sweet almonds are the type that is eaten. They are oval in shape, usually malleable in texture and wonderfully buttery in taste. They are available in the market either still in their shell or with their shell removed. Shelled almonds are available whole, sliced or slivered in either their natural form, with their skin, or blanched, with their skin removed.

Bitter almonds are used to make almond oil that is used as a flavoring agent for foods and liqueurs such as Amaretto. They are otherwise inedible as they naturally contain toxic substances such as hydrocyanic acid. These compounds are removed in the manufacturing of almond oil.

History

Almonds are an ancient food that have been written about in historical texts, including the Bible. Almonds were thought to have originated in regions in western Asia and North Africa. The Romans referred to almonds as the "Greek nut" in reference to the civilization suggested to have first cultivated them.

Almonds are now grown in many of the countries that border the Mediterranean Sea including Spain, Italy, Portugal and Morocco, as well as in California. The cultivation of almonds in California, the only state that produces them, has an interesting history. Almond trees were originally brought to California centuries ago when missions were created by the Spanish, but cultivation of the trees was abandoned when the missions were closed. Almond trees found their way back to California in the 19th century via the eastern United States. In 1840, almond trees were brought over from Europe and were first planted in New England. Because the climate on the Eastern seaboard did not support their cultivation, the trees were brought to California where they thrived and continue to do so.

How to Select and Store

Almonds that are still in their shells have the longest shelf life. If purchasing these, look for shells that are not split, moldy or stained. Shelled almonds that are stored in an hermetically sealed container will last longer than those that are sold in bulk bins since they are less exposed to heat, air and humidity. If purchasing almonds in bulk bins, make sure that the store has a quick turnover of inventory and that the bulk containers are sealed well in order to ensure maximum freshness. Look for almonds that are uniform in color and not limp or shriveled. In addition, smell the almonds. They should smell sweet and nutty; if their odor is sharp or bitter, they are rancid.

If you want almonds with a roasted flavor and texture, choose those that have been "dry roasted" as they are not cooked in oil like their regular roasted counterparts. Yet, even when purchasing "dry roasted" almonds, it is important to read the label to be sure that no additional ingredients such as sugar, corn syrup or preservatives have been added.

Since almonds have a high fat content, it is important to store them properly in order to protect them from becoming rancid. Store shelled almonds in a tightly sealed container, in a cool dry place away from exposure to sunlight. Keeping them cold will further protect them from rancidity and prolong their freshness. Refrigerated almonds will keep for several months, while if stored in the freezer, almonds can be kept for up to a year. Shelled almond pieces will become rancid more quickly than whole shelled almonds. Almonds still in the shell have the longest shelf life.

How to Enjoy

In addition to being eaten raw, almonds are a wonderful addition to a variety of recipes from salads to baked goods.

For some of our favorite recipes, click Recipes.

Tips for Preparing Almonds:

Whole shelled almonds can be chopped by hand or can be placed in a food processor. If using a food processor, it is best to pulse on and off a few times, instead of running the blade constantly, as this will help ensure that you end up with chopped almonds rather than almond butter. To roast almonds at home, do so gently—in a 160-170°F (about 75°C) oven for 15-20 minutes—to preserve the healthy oils. For more on the effect of high heat roasting on nuts, please see this article

We don't recommend blanching almonds because blanching nuts removes their skin and they are no longer considered a whole food. Studies have shown that the skin of nuts are nutrient-rich. For example, researchers found that the flavonoid phytonutrients found in almond skins team up with the vitamin E present in their meat to more than double the antioxidant power delivered by either one of these nutrients separately.

A few quick serving ideas:

Add a punch to plain yogurt by mixing in some chopped almonds and dried fruit.

Enhance a healthy saute of curried vegetables with sliced almonds.

Add some almond butter to a breakfast shake to boost its taste and protein content.

Almonds and apple slices make a wonderfully simple, on-the-go power snack.

Make a delightful cold rice salad with almonds, fresh garden peas and currants.

Add sliced almonds to chicken salad.

Safety

Oxalate Content

Almonds have consistently been determined to have high oxalate content. Oxalates are naturally occurring organic acids found in a wide variety of foods, and in the case of certain medical conditions, they must be greatly restricted in a meal plan to prevent over-accumulation inside the body. Our comprehensive article about oxalates will provide you with practical and detailed information about these organic acids, food, and health.

Almonds and Food Allergies

Tree nuts, such as almonds, are among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Almonds, sliced, raw
0.25 cup
23.00 grams

Calories: 132
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
biotin	14.72 mcg	49	6.7	very good
vitamin E	6.03 mg (ATE)	40	5.5	very good
manganese	0.53 mg	27	3.6	very good
copper	0.23 mg	26	3.5	very good
vitamin B2	0.23 mg	18	2.4	good
phosphorus	111.32 mg	16	2.2	good
magnesium	61.64 mg	15	2.1	good
molybdenum	6.78 mcg	15	2.1	good
fiber	2.81 g	11	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Cashews

The delicately flavored cashew nut is a favorite between meal snack that can be readily found in your local market year round. It also makes wonderful nut butter and a special addition to salads and stir-fry dishes.

Cashew nuts are actually the kidney-shaped seeds that adhere to the bottom of the cashew apple, the fruit of the cashew tree, which is native to the coastal areas of northeastern Brazil. While cashew apples are not appreciated in the United States, they are regarded as delicacies in Brazil and the Caribbean. Cashews are always sold shelled because the interior of the shells contains a caustic resin, known as cashew balm, which must be carefully removed before the nuts are fit for consumption. This caustic resin is actually used in industry to make varnishes and insecticides.

Cashews, raw
0.25 cup
(40.00 grams)

Calories: 221
GI: low

Nutrient	DRI/DV
copper	98%
phosphorus	34%
manganese	33%
magnesium	29%
zinc	21%

Health Benefits

Heart-Protective Monounsaturated Fats

Not only do cashews have a lower fat content than most other nuts, approximately 82% of their fat is unsaturated fatty acids, plus about 66% of this unsaturated fatty acid content are heart-healthy monounsaturated fats, similar to those found in olive oil. Studies of diabetic patients show that monounsaturated fat, when added to a low-fat diet, can help to reduce high triglyceride levels. *Triglycerides* are a form in which fats are carried in the blood, and high triglyceride levels are associated with an increased risk for heart disease, so ensuring you have some monounsaturated fats in your diet by enjoying cashews is a good idea, especially for persons with diabetes.

Crazy about Your Heart? Go Nuts

Research published in the *British Journal of Nutrition* (Blomhoff R, Carlsen MH), which identified several nuts among plant foods with the highest total antioxidant content, suggests nut's high antioxidant content may be key to their cardio-protective benefits.

Nuts' high antioxidant content helps explain results seen in the Iowa Women's Health Study in which risk of death from cardiovascular and coronary heart diseases showed strong and consistent reductions with increasing nut/peanut butter consumption. Total death rates decreased 11% and 19% for nut/peanut butter intake once per week and 1-4 times per week, respectively.

Even more impressive were the results of a review study of the evidence linking nuts and lower risk of coronary heart disease, also published in the *British Journal of Nutrition*. (Kelly JH, Sabate J.) In this study, researchers looked at four large prospective epidemiological studies—the Adventist Health Study, Iowa Women's Study, Nurses' Health Study and the Physician's Health Study. When evidence from all four studies was combined, subjects consuming nuts at least 4 times a week showed a 37% reduced risk of coronary heart disease compared to those who never or seldom ate nuts. Each additional serving of nuts per week was associated with an average 8.3% reduced risk of coronary heart disease.

Practical Tip: To lower your risk of cardiovascular and coronary heart disease, enjoy a handful of cashews or other nuts, or a tablespoon of nut butter, at least 4 times a week.

Copper for Antioxidant Defenses, Energy Production, Bones and Blood Vessels

An essential component of many enzymes, copper plays a role in a wide range of physiological processes including iron utilization, elimination of free radicals, development of bone and connective tissue, and the production of the skin and hair pigment called melanin. For example, copper is an essential component of the enzyme, *superoxide dismutase*, which is important in energy production and antioxidant defenses. Copper is also necessary for the activity of *lysyl oxidase*, an enzyme involved in cross-linking collagen and elastin, both of which provide the ground substance and flexibility in blood vessels, bones and joints. Low dietary intake of copper may also be associated with increased fecal free radical production and fecal water alkaline phosphatase activity, risk factors for colon cancer.

Numerous health problems can develop when copper intake is inadequate, including iron deficiency anemia, ruptured blood vessels, osteoporosis, joint problems such as rheumatoid arthritis, brain disturbances, elevated LDL (bad) cholesterol and reduced HDL (good) cholesterol levels, irregular heartbeat, and increased susceptibility to infections.

Bone Up and Relax with Cashews

Everyone knows that calcium is necessary for strong bones, but magnesium is also vital for healthy bones. About two-thirds of the magnesium in the human body is found in our bones. Some helps give bones their physical structure, while the rest is found on the surface of the bone where it is stored for the body to draw upon as needed.

Magnesium, by balancing calcium, helps regulate nerve and muscle tone. In many nerve cells, magnesium serves as Nature's own calcium channel blocker, preventing calcium from rushing into the nerve cell and activating the nerve. By blocking calcium's entry, magnesium keeps our nerves (and the blood vessels and muscles they ennervate) relaxed. If our diet provides us with too little magnesium, however, calcium can gain free entry, and the nerve cell can become overactivated, sending too many messages and causing excessive contraction.

Insufficient magnesium can thus contribute to high blood pressure, muscle spasms (including spasms of the heart muscle or the spasms of the airways symptomatic of asthma), and migraine headaches, as well as muscle cramps, tension, soreness and fatigue. Given these effects, it is not surprising that studies have shown magnesium helps reduce the frequency of migraine attacks, lowers blood pressure, helps prevent heart attacks, promotes normal sleep patterns in women suffering from menopausal sleep disturbances, and reduces the severity of asthma.

Help Prevent Gallstones

Twenty years of dietary data collected on 80,000 women from the Nurses' Health Study shows that women who eat least 1 ounce of nuts, peanuts or peanut butter each week have a 25% lower risk of developing gallstones. Since 1 ounce is only 28.6 nuts or about 2 tablespoons of nut butter, preventing gallbladder disease may be as easy as packing one cashew butter and jelly sandwich (be sure to use whole wheat bread for its fiber, vitamins and minerals) for lunch each week, having a handful of cashews as an afternoon pick me up, or tossing some cashews on your oatmeal or salad.

Eating Nuts *Lowers* Risk of Weight Gain

Although nuts are known to provide a variety of cardio-protective benefits, many avoid them for fear of weight gain. A prospective study published in the journal *Obesity* shows such fears are groundless. In fact, people who eat nuts at least twice a week are much *less* likely to gain weight than those who almost never eat nuts.

The 28-month study involving 8,865 adult men and women in Spain, found that participants who ate nuts at least two times per week were 31% less likely to gain weight than were participants who never or almost never ate nuts.

And, among the study participants who gained weight, those who never or almost never ate nuts gained more (an average of 424 g more) than those who ate nuts at least twice weekly.

Study authors concluded, "Frequent nut consumption was associated with a reduced risk of weight gain (5 kg or more). These results support the recommendation of nut consumption as an important component of a cardioprotective diet and also allay fears of possible weight gain."

Practical Tip: Don't let concerns about gaining weight prevent you from enjoying the delicious taste and many health benefits of nuts!

- Spread some nut butter on your morning toast or bagel.
- Remember how many great childhood lunches involved a peanut butter and jelly sandwich? Upgrade that lunchbox favorite by spreading organic peanut butter and concord grape jelly on whole wheat bread.

- Fill a celery stick with nut butter for an afternoon pick-me-up.
- Sprinkle a handful of nuts over your morning cereal, lunchtime salad, dinner's steamed vegetables.
- Or just enjoy a handful of lightly roasted nuts as a healthy snack.

Description

Cashew nuts are actually seeds that adhere to the bottom of the cashew apple, the fruit of the cashew tree, which is native to the coastal areas of northeastern Brazil. Cashew apples, while not known in the U.S., are regarded as delicacies in Brazil and the Carribean. The seed we know as the kidney-shaped cashew "nut" is delicate in flavor and firm, but slightly spongy, in texture.

You have probably noticed that cashews in the shell are not available in stores. This is because these nuts are always sold pre-shelled since the interior of their shells contains a caustic resin, known as cashew balm, which must be carefully removed before they are fit for consumption. This caustic resin is actually used in industry to make varnishes and insecticides.

Cashews, known scientifically as *Anacardium occidentale*, belong to the same family as the mango and pistachio nut.

History

The cashew tree is native to coastal areas of Brazil. In the 16th century, Portuguese explorers took cashew trees from this South American country and introduced them into other tropical regions such as India and some African countries, where they are now also cultivated. The cashew tree has always been a prized resource owing to its precious wood, cashew balm and cashew apple, but the cashew nut itself did not gain popularity until the beginning of the 20th century. Today, the leading commercial producers of cashews are India, Brazil, Mozambique, Tanzania and Nigeria.

How to Select and Store

Cashews are generally available in prepackaged containers as well as bulk bins. Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the cashews are covered and that the store has a good product turnover so as to ensure its maximal freshness. Whether purchasing cashews in bulk or in a packaged container, make sure that there is no evidence of moisture or insect damage and that they are not shriveled. If it is possible to smell the cashews, do so in order to ensure that they are not rancid.

Due to their high content of oleic acid, cashews are more stable than most other nuts but should still be stored in a tightly sealed container in the refrigerator, where they will keep for about six months, or in the freezer, where they will keep for about one year. Cashew butter should always be refrigerated once it is opened.

How to Enjoy

A Few Quick Serving Ideas

- Combining cashews with other nuts and dried fruits makes a healthy snack.
- Right before taking off the heat, add cashews to healthy sautéed vegetables.

  Healthy sauté cashews with shrimp, basil and green beans for a delightful Thai inspired dish.

- Cashews with a little bit of maple syrup make a great topping for hot cereals.
- Add cashew butter to breakfast soy or rice milk shakes to up their protein content (a quarter-cup of cashews provides over 5 grams of protein) and give them a creamy nutty taste.
- In a saucepan over low-medium heat, mix cashew butter with some soy sauce, cayenne pepper, garlic, ginger and water to make a wonderful sauce for fish, vegetables, tofu or rice.
- To roast cashews at home, do so gently—in a 160-170°F (about 75°C) oven for 15-20 minutes—to preserve the healthy oils. For more on the effect of high heat roasting on nuts, please see the following article.

For some of our favorite recipes, click Recipes.

Safety

Oxalate Content

Cashews have consistently been determined to have high oxalate content. Oxalates are naturally occurring organic acids found in a wide variety of foods, and in the case of certain medical conditions, they must be greatly restricted in a meal plan to prevent over-accumulation inside the body. Our comprehensive article about oxalates will provide you with practical and detailed information about these organic acids, food, and health.

Cashews and Food Allergies

Tree nuts, such as cashews, are among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Cashews, raw
0.25 cup
40.00 grams

Calories: 221
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
copper	0.88 mg	98	8.0	excellent
phosphorus	237.20 mg	34	2.8	good
manganese	0.66 mg	33	2.7	good
magnesium	116.80 mg	29	2.4	good
zinc	2.31 mg	21	1.7	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Flaxseeds

What's New and Beneficial About Flaxseeds

- Finding creative ways to add flaxseeds to your meals can be a challenge. One popular technique is to incorporate ground flaxseeds into your muffin, cookie, or bread recipes. Recent research studies have shown that ground flax can be added to baked foods without sacrificing large amounts of alpha-linolenic acid (ALA), their showcase omega-3 fatty acid that accounts for over half of their total fat content. Oven temperatures of 300F (150C) - even over several hours of baking time - do not appear to substantially reduce the amount of ALA in baked products. This outcome has been demonstrated for breads, muffins and cookies. Even when flaxseeds are ground prior to incorporatation into breads and pastas, these preparation methods - involving grinding prior to heating - only appear to lower ALA levels by about 4-8%. Interestingly, bread enriched with ground flaxseed has also been shown to have a greater antioxidant capacity and a much lower glycemic index value (of approximately 51) than the same bread without the ground flaxseed addition. These research findings are great news for anyone who wants to include flaxseeds in baked dishes, in either whole or ground form.
- Most plant foods contain at least small amounts of phytonutrients called lignans. Lignans are unique fiber-related polyphenols that provide us with antioxidant benefits, fiber-like benefits, and also act as phytoestrogens. Among all commonly eaten foods, researchers now rank flaxseeds as the #1 source of lignans in human diets. Flaxseeds contain about 7 times as many lignans as the closest runner-up food (sesame seeds). They contain about 338 times as many lignans as sunflower seeds, 475 times as many as cashew nuts, and 3,200 times as many lignans as peanuts.
- When we think about antioxidant-rich foods, the first foods that come to mind are typically vegetables and fruits. Of course, foods in both of these food groups can be outstanding sources of antioxidants! Yet according to recent research, flaxseeds also belong high up on our list of antioxidant-rich foods. When flaxseeds are compared with other commonly eaten foods in terms of their total polyphenol content (polyphenols are one very important group of antioxidants), flaxseeds rank 9th among 100 commonly eaten foods. Flaxseeds turn out to be significantly higher in polyphenol antioxidants than fruits like blueberries or vegetables like olives. The antioxidant benefits of flaxseeds have long been associated with prevention of cardiovascular diseases and have recently also been tied to decreased insulin resistance.
- Given the strong track record of flaxseeds as foods providing cardiovascular benefits, it's not surprising to see recent research studies showing benefits of flaxseeds for improvement of metabolic syndrome (MetS). One recent study showed a 20% decrease in the prevalence of MetS after 12 weeks on a diet plan that included 30 grams (1 ounce) of ground flaxseed per day in the form of flaxseed-enriched baked bread. Interestingly, in addition to improving blood pressure and lowering fasting glucose level, flaxseed intake also helped decrease central obesity (as measured by waist circumference). The addition of flaxseed provided all of these health benefits without causing weight gain. That's quite an accomplishment for a food that is over 70% fat in terms of total calories and contains about 10 times as many calories per cup as a fruit like blueberries.

WHFoods Recommendations

Based upon research and public health recommendations, we believe that a combination of nuts and seeds (including flaxseeds), that adds up to 3 tablespoons (1.5 ounces, or 42 grams) per day is a dietary step well worth taking for most people. For more background on this recommendation, please see this article.

Flaxseeds, ground, raw
2.00 TBS
(14.00 grams)

Calories: 75
GI: very low

Nutrient	DRI/DV
omega-3 fats	133%
vitamin B1	19%
copper	19%
manganese	18%
fiber	15%
magnesium	14%
phosphorus	13%
selenium	6%

Health Benefits

The seeds of most plants are rich in nutrients and can provide us with health benefits. Yet flaxseeds are also nutritionally unique and offer us health benefits not found across the board within the seeds food group. The nutritional uniqueness of flaxseeds features three nutrient aspects, and all three play a key role in the outstanding health benefits of this food.

Unique Nutrient Features of Flaxseeds

The first unique feature of flax is its high omega-3 fatty acid content. Among all 127 World's Healthiest Foods, flaxseeds comes out number one as a source of omega-3s! The primary omega-3 fatty acid found in flaxseeds is alpha-linolenic acid, or ALA. The ALA in flaxseed has found to be stable for at least 3 hours of cooking at oven temperatures (approximately 300F/150C), which makes it available after ground flaxseeds have been added to baked goods like muffins or breads.

The second unique feature of flaxseed is its lignans. Lignans are fiber-like compounds, but in addition to their fiber-like benefits, they also provide antioxidant protection due to their structure as polyphenols. The unique structure of lignans gives them a further health-supportive role to play, however, in the form of phytoestrogens. Along with isoflavones, lignans are one of the few naturally occurring compounds in food that function as weak or moderate estrogens when consumed by humans. Among all foods commonly eaten by humans, researchers rank flaxseeds as the number one source of lignans. Sesame seeds come in second, but contain only one-seventh of the total lignans as flaxseeds. To give a few further examples, sunflower seeds contain about 1/350th as many lignans, and cashews nuts contain about 1/475th as many lignans as flaxseeds.

A third unique feature of flaxseeds is their mucilage (gum) content. "Mucilage" refers to water-soluble, gel-forming fiber that can provide special support to the intestinal tract. For example, gums can help prevent the too rapid emptying of the stomach contents into the small intestine, thereby improving absorption of certain nutrients in the small intestine. Arabinoxylans and galactoxylans are included within the mucilage gums found in flaxseeds.

This combination of features—omega-3 fatty acids, high-lignan content, and mucilage gums—is a key factor in the unique health benefits of flaxseeds. The specific areas of health benefit described below all draw in some way from this unique combination of nutrients not found in other commonly eaten nuts or seeds.

Cardiovascular Benefits

The primary omega-3 fatty acid in flaxseeds—alpha-linolenic acid, or ALA—can be helpful to the cardiovascular system in and of itself. As the building block for other messaging molecules that help prevent excessive inflammation, ALA can help protect the blood vessels from inflammatory damage. Numerous studies have shown the ability of dietary flaxseeds to increase our blood levels of ALA, even when those flaxseeds have been ground and incorporated into baked goods like breads or muffins. When flaxseeds are consumed, two other omega-3 fatty acids have also been shown to increase in the bloodstream, namely, eicosapentaenoic acid (EPA) and docosapentaenoic acid (DPA). Increases in EPA and DPA also help provide inflammatory protection.

Protection of our blood vessels from inflammatory damage is also provided by the lignans in flaxseeds. These lignans can inhibit formation of platelet activating factor (PAF), which increases risk of inflammation when produced in excessive amounts. The overall anti-inflammatory benefits of ALA and lignans in flaxseeds has been further corroborated by studies in which flaxseed-enriched baked goods (like muffins) lead to decreases of 10-15% in C-reactive protein (CRP) levels. CRP levels are a commonly used indicator of inflammatory status in the cardiovascular system.

Risk of oxidative stress in the blood vessels can also be lowered by flaxseed intake. In addition to being a very good source of the mineral antioxidant manganese, polyphenols in flaxseed—including flaxseed lignans—provide measurable antioxidant benefits. The antioxidant benefits of one particular flaxseed lignan, secoisolariciresinol, have been especially well-documented. Decreased lipid peroxidation and decreased presence of reactive oxygen species (ROS) in the bloodsteam have both been associated with flaxseed intake in amounts of approximately 2 tablespoons per day.

Intake of flaxseeds has also been shown to decrease the ratio of LDL-to-HDL cholesterol in several human studies and to increase the level of apolipoprotein A1, which is the major protein found in HDL cholesterol (the "good" cholesterol). This HDL-related benefit may be partly due to the simple fiber content of flaxseeds, since 2 tablespoons of ground flaxseed provide about 4 grams of dietary fiber.

Although direct studies on flaxseed and blood pressure are limited (and mostly confined to flaxseed oil versus ground flaxseed), numerous studies have shown the ability of increased omega-3 fatty acid intake to help regulate blood pressure and to help reduce blood pressure in persons who have been diagnosed with hypertension. With its excellent content of the omega-3 fatty acid alpha-linolenic acid (ALA), flaxseed can definitely help us increase our overall omega-3 intake and, by doing so, decrease our risk of high blood pressure.

There is one area of concern that we want to note involving flaxseeds and the cardiovascular system. We've seen one very small-scale study from Canada involving 30 children and teens (ages 8-18), all previously diagnosed with hypercholesterolemia (high cholesterol) and given added flaxseed in their diets over a period of 4 weeks. The flaxseed amount was 2 tablespoons, and the form was ground flaxseeds incorporated into breads and muffins. In this study, blood levels of total cholesterol and LDL cholesterol did not significantly change, but blood fat levels (in the form of triglycerides) increased and HDL cholesterol (the "good" cholesterol) decreased. Since we would consider these changes in blood lipids to be unwanted, we believe this study raises some preliminary questions about the role of daily flaxseeds in amounts of 2 tablespoons or above in the diet of children and teenagers who are already known to have high cholesterol. Much more research is needed in this area, but if you are the parent of a child or teen who is already diagnosed with high cholesterol, we recommend that you consult with your healthcare provider about the pros and cons of incorporating flaxseeds into your child's meal plan on a daily basis in any substantial amount.

Antioxidant and Anti-Inflammatory Benefits

It is important to realize that the antioxidant and anti-inflammatory benefits of flaxseed do not apply only to the cardiovascular system. Oxidative stress (which is often related to deficient intake of antioxidant nutrients) and excessive inflammation (which can also be related to deficient intake of anti-inflammatory nutrients) are common risk factors for a wide variety of health problems. These problems include development of insulin resistance, type 2 diabetes, asthma, obesity, and metabolic syndrome. There is preliminary evidence that flaxseed intake can decrease risk of all the problems above by increasing our anti-inflammatory and antioxidant protection.

Cancer Prevention

The antioxidant and anti-inflammatory benefits of flaxseeds also make them a logical candidate for cancer prevention. That's because chronic inflammation (even low level inflammation) and chronic oxidative stress are risk factors for cancer development. In the case of flaxseeds, evidence of risk reduction is strongest for breast cancer, prostate cancer, and colon cancer. Breast cancer and prostate cancer are included in the list of cancers know as "hormone-related" cancers. Their risk reduction may be more closely related to flaxseed than risk reduction for other cancers due to the high lignan content of flaxseed.

Three of the lignans found in flaxseeds—secoisolariciresinol, matairecinol, and pinoresinol—can be converted by intestinal bacteria into enterolactone (ENL) and enterodiol (END). ENL and END have direct affects on our hormonal balance and in this way may play an especially important role in hormone-related cancer. In addition to decreased risk of breast and prostate cancer following flaxseed intake, there is also some preliminary evidence that ENL and END may be able to alter the course of hormone-dependent tumors once they are formed. The relationship between flaxseed intake and cancer prevention is complicated, however, due to the important role of gut bacteria in converting secoisolariciresinol and other lignans in flax into enterolactone and enterodiol. This conversion process involves many different enzyme-related steps provided by a complicated mix of gut bacteria including *Bacteriodes*, *Bifidobacterium*, *Butyribacterium*, *Eubacterium* and others.

The lignans provided by flaxseed have also been shown to spark increased activity by certain Phase II detoxification enzymes that are responsible for deactivating toxins in the body. This support of the detox process may help prevent accumulation of toxins that might otherwise act as carcinogens and increase cancer risk.

Digestive Health

Benefits of flaxseed for the digestive tract—although mentioned earlier throughout this food profile—are worth repeating here. The strong fiber content of flaxseeds—including their mucilaginous fiber—help to delay gastric emptying and can improve intestinal absorption of nutrients. Flaxseed fibers also help to steady the passage of food through our intestines. Finally, the lignans in flaxseed have been shown to reduce risk of colon cancer. This impressive group of digestive tract benefits is likely to receive more attention in future research studies.

Flaxseeds and Post-Menopausal Symptoms

We've seen mixed findings in the area of post-menopausal benefits (such as reduction of hot flashes) and flaxseed intake, with some studies showing significant benefits and other studies showing a lack of significant benefits. However, there continues to be strong interest in flaxseeds and their components (including enterolactone and secoisolariciresinol diglucoside) as potential aids during management of perimenopausal and postmenopausal symptoms as well as during hormone replacement therapy (HRT).

This area of flaxseed research is admittedly complex. For example, enterolactone made from flaxseed lignans has been shown to be an estrogen agonist (promoting estrogen production, through increased formation of transcription factors like ER-alpha and ER-beta), as well as an estrogen antagonist (working against estrogen production, through inhibition of enzymes like estrogen synthetase). It's also known to lower the activity of 5-alpha-reductase (an enzyme that converts testosterone into dihydrotestosterone) and 17-beta hydroxysteroid dehydrogenase (an enzyme that converts estrone into estradiol). Given this complicated set of circumstances that may vary from one woman to another, it may turn out that flaxseed intake is simply better at lessening menopausal symptoms in some women, and not as good at lessening symptoms in others.

Other Health Benefits

Although we've already mentioned decreased risk of insulin resistance in relationship to flaxseed intake, we're definitely expected to see more research studies in this area. The strong fiber content, antioxidant content, and anti-inflammatory content of flaxseeds make them a natural here.

One final note about the health benefits of flaxseeds involves their feeding to animals. We've seen repeated studies on the content of beef, chicken, and eggs that reflect significantly increased omega-3 content in these foods when flaxseed meal and/or flaxseed oil are added to the diets of cows and chickens. For persons who enjoy these foods in their meal plan on a regular basis, this increased omega-3 content can really add up. Some manufacturers of beef, chicken, and eggs provide omega-3 information on their product packaging. Consumption of certified organic animal foods in which flaxseed was added to the animals' feed can be an effective way of increasing your omega-3 intake.

Description

The scientific name for flax—*Linum usitatissimum*— reveals a lot about our human relationship to this plant. The "linum" part of this name sounds a lot like "linen," which is a fabric that has been made from flax for over 3,000 years. The "*usitatissimum*" part of its name means "of greatest use" in Latin, and that quality also rings true in our relationship to flax. This plant has served not only as a food source and source of linen, but also for the creation of sails on sailing ships, bowstrings, and body armor. Flaxseed is known in many parts of the world as "linseed," although most of the linseed oil sold in the United States is not food grade and is sold instead for use as a wood finish and preservative.

Brown flax and golden flax (sometimes called yellow flax) are the two basic varieties of flax, and they are similar in their nutritional composition, with one important exception. One specific strain of yellow flax called "solin" was been developed by agricultural scientists to be processed and sold as a cooking oil that could substitute for oils like sunflower seed oil. Solin has been approved by the Food and Drug Administration (FDA) as a GRAS list food, and it is sometimes being produced under the trademarked name "Linola" (TM). Since solin (Linola TM) only contains about 1/10th of the alpha-linolenic (ALA) content of other the brown and golden flax varieties, it definitely should not be considered equivalent from a nutritional standpoint.

One additional clarification about varieties of flax is also important. New Zealand flax, even though it bears the same name, is not related to the flax plant *Linum usitatissimum* whose flaxseeds we recommend as a World's Healthiest Food. New Zealand flax also has a rich history of use for its fiber content, however, as well as traditional medicinal uses as developed by the Maori peoples of New Zealand.

In their raw form, flaxseeds usually range from amber/yellow/gold in color to tan/brown/reddish brown. White or green flaxseeds have typically been harvested before full maturity, and black flaxseeds have typically been harvested long after full maturity. Generally speaking, we recommend avoiding raw flaxseeds that are white, green, or black in color.

History

Sometime between 4000 and 2000 BC, flax cultivation became a common practice in countries bordering the Mediterranean Sea and in regions of the Middle East, and there is some evidence that flax cultivation may have started even thousands of years earlier, during the Neolithic Era of approximately 10,000 BC. From the very beginning, the value of flax was both culinary and domestic, since flax fibers could be spun into linen to provide clothing and other textile-related products.

To this day, flax cultivation has remained both culinary and domestic, although crop production has become more specialized and wide scale. In the United States and Canada, most commercial flax production involves oilseed varieties of flax, in which the seeds will eventually be dried and crushed and used to produce different grades of oil. Non-food grade flaxseed/linseed oil is used in wood finishes, paints, coatings, and other industrial supplies. Food grade flaxseed/linseed oil can as be used in livestock feed, or as a culinary oil. (It is much more common, however, for livestock feed to contain flaxseed meal versus flaxseed oil.) Oilseed varieties of flax are typically classified as oilseed crops along with soybeans, rapeseed, cottonseed, sunflower seed, and peanuts. Canada is the world's largest producer of oilseed flax, followed by Russia, France, and Argentina.

Fiber flax is the other major variety of flax in terms of commercial production. In Europe, France and Belgium are especially large producers of fiber flax. While cotton, wool and silk remain the most popular natural fibers in the global textile market, the global flax market has grown in recent years following increased production of linen products in China.

Alongside of these other flax markets, however, has developed a gradually expanding consumer market for flaxseeds themselves, to be considered as uniquely nourishing food. We expect to see food interest in flaxseeds increase, primarily because of their unique nutrient combinations and health benefits.

How to Select and Store

Flaxseeds can be purchased either whole or already ground. The two different forms offer distinct benefits. Because flaxseeds can be very difficult to chew, grinding of the seeds prior to consumption can usually increase their digestibility. However, grinding takes time, and pre-ground flaxseeds can have great convenience. On the other side of the coin, pre-ground flaxseeds —while more convenient—also come with a shorter shelf life than whole flaxseeds. Ground flaxseeds—even when carefully packaged in a gas-flushed, light-protective pouch and refrigerated after opening—typically last about 6-16 weeks. Whole flaxseeds, on the other hand, will typically last for 6-12 months when stored in an airtight container in a dark, cool dry spot. If directly refrigerated, they may last for 1-2 years.

Whole flaxseeds are generally available in prepackaged containers as well as bulk bins. Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the flaxseeds are covered and that the store has a good product turnover so as to ensure their maximal freshness. Whether purchasing flaxseeds in bulk or in a packaged container, make sure that there is no evidence of moisture. If you purchase whole flaxseeds, either store them in an airtight container in a dark, dry and cool place or place their airtight container directly in the refrigerator.

Ground flaxseeds are usually available both refrigerated and non-refrigerated. If you are purchasing ground flaxseed that is sitting on the store shelf at room temperature, we highly recommended that the flaxseed be packaged in a gas-flushed, vacuum-sealed bag. If you are purchasing ground flaxseed that is found in the refrigerator section, it's not essential that vacuum-sealed packaging be used, but it can still be helpful from a food quality standpoint. Regardless of the form in which you purchase your ground flaxseeds, you should keep their container in the refrigerator after opening. The reason for all of this extra precaution is simple: once flaxseeds are ground, they are much more prone to oxidation and spoilage. Similarly, if you are grinding whole flaxseeds on your own at home (for example, in a small spice or coffee grinder), you'll want to store them in the refrigerator in an airtight container. If using glass, you may also want to use a darkened glass as that will lessen exposure of the ground flaxseeds to light.

Flaxseed oil is especially perishable and should always be purchased in opaque bottles that have been kept refrigerated. Flaxseed oil should have a sweet nutty flavor. We never recommend the use of flaxseed oil in cooking, since it is far too easily oxidized. However, it's fine to add flaxseed oil to foods after they have been cooked. For more on our recommendations on flaxseed oil, see this Q+A.

How to Enjoy

A Few Quick Serving Ideas

- Sprinkle ground flaxseeds onto your hot or cold cereal.
- Add flaxseeds to your homemade muffin, cookie or bread recipe.
- To pump up the nutritional volume of your breakfast shake, add ground flaxseeds.
- To give cooked vegetables a nuttier flavor, sprinkle some ground flaxseeds on top of them.
- Add a tablespoon of flaxseed oil to smoothies.

Safety

"Cyanide" is a term that we typically associate with the potentially deadly poison, hydrogen cyanide. However, there are very small amounts of cyanide constantly present and undergoing metabolism in human tissue. These small amounts of cyanide are found in relatively non-toxic forms like thiocyanates. Of course, these same thiocyanates are also found to occur naturally in foods (for example, in cruciferous vegetables). Linamarin and lotaustralin are two of the primary cyanogenic glycosides in flaxseeds, and like the thiocyanates in cruciferous vegetables, both of these compounds can contribute to cyanide metabolism in humans. However, as long as our metabolic processes are not overloaded and we are in reasonably good health, about two tablespoons of flaxseeds per day are likely to provide too little linamarin and lotaustralin to cause an adverse reaction. We've seen research on flaxseed meal, for example, which shows about 5-6 milligrams of cyanogenic glycosides (CGs) in one tablespoon. (And to give you a comparison, oral doses of sodium cyanide and potassium cyanide that cause acute and dangerous toxicity in humans fall into the range of 1000's of milligrams.)

It's not actually the CGs themselves that pose a risk, but their breakdown by an enzyme called beta-glucosidase that results in the release of hydrogen cyanide. When beta-glucosidase is unavailable or ineffective in breaking apart the CGs, we don't get faced with the hydrogen cyanide risk. And even when beta-glucosidase does break apart the CGs, there's an enzyme in our body called rhodanase that can convert hydrogen cyanide into the relatively non-toxic form of thiocyanate.

The issue of cooking and CGs in flaxseeds is somewhat ambiguous. We've see one study in which the baking of flax-flour containing muffins at 230F for 15-18 minutes showed no CGs in the final product. That result would point to a helpful impact of cooking on cyanide-related risk. We've also seen a study in which the overnight soaking of cassava, fermentation of cassava, as well as boiling, steaming, and dry heating of cassava all resulted in decreased CG content, with decreases falling into a very wide range of 32-99% range. While cassava is a food which can have the exact same amount of CGs as flaxseed, and in some cases, much higher amounts, it is also a food that is less compact and more porous than flaxseeds, and it would be expected to respond differently to cooking. In one study on commercial processing of flax, 20-30 minutes of heating at 150-221F did not appear to alter the CG content of the seeds or the processed flaxseed flakes or flaxseed cakes. From all of these studies, our overall conclusion is as follows: you may well benefit from the cooking of flaxseeds as a way of decreasing your cyanide-related risks, but you also may have no compelling reason to do so, since (1) the amount of CGs contained in 1-2 tablespoons is relatively small; (2) not all CGs will get broken down by enzymes and converted into hydrogen cyanide; and (3) if hydrogen cyanide does get created, most healthy persons will be able to detoxify it when it is present in such relatively small amounts.

Some people have gastrointestinal symptoms, such as flatulence and bloating, when they first begin to incorporate flaxseeds into their diet. It is suggested to start with a small amount, such as one teaspoon, and slowly build yourself up to your intake goal. When increasing fiber intake in the diet, it is also a good idea to include fluid (water) intake as well.

Several animal studies (involving rats and mice) have raised questions about the safety of high-dose flaxseeds during pregnancy—not for the pregnant females, but for their offspring. "High-dose" in these animal experiments has meant flax intake as 10% of the total diet, or about 4 tablespoons of flaxseed for every 2,000 calories. Although it is impossible to generalize from animal studies to humans, we recommend that women who are pregnant (or considering pregnancy) consult with their healthcare providers if they are consuming or planning to consume flaxseeds in these high amounts.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Flaxseeds, ground, raw
2.00 TBS
14.00 grams

Calories: 75
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
omega-3 fats	3.19 g	133	32.0	excellent
vitamin B1	0.23 mg	19	4.6	very good
copper	0.17 mg	19	4.5	very good
manganese	0.35 mg	18	4.2	very good
fiber	3.82 g	15	3.7	very good
magnesium	54.88 mg	14	3.3	good
phosphorus	89.88 mg	13	3.1	good
selenium	3.56 mcg	6	1.6	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Peanuts

Peanuts, raw
0.25 cup
(36.50 grams)

Calories: 207
GI: low

Nutrient	DRI/DV
copper	47%
manganese	36%
vitamin B3	28%
molybdenum	24%
folate	22%
biotin	21%
phosphorus	20%
vitamin E	20%
protein	19%
vitamin B1	19%

Health Benefits

In addition to being every kid's (and many grownup kid's) favorite sandwich filling, peanuts pack a serious nutritional punch and offer a variety of health benefits.

Your Heart Will Go Nuts for Peanuts

Peanuts are rich in monounsaturated fats, the type of fat that is emphasized in the heart-healthy Mediterranean diet. Studies of diets with a special emphasis on peanuts have shown that this little legume is a big ally for a healthy heart. In one such randomized, double-blind, cross-over study involving 22 subjects, a high monounsaturated diet that emphasized peanuts and peanut butter decreased cardiovascular disease risk by an estimated 21% compared to the average American diet.

In addition to their monounsaturated fat content, peanuts feature an array of other nutrients that, in numerous studies, have been shown to promote heart health. Peanuts are good sources of vitamin E, niacin, folate, protein and manganese. In addition, peanuts provide *resveratrol*, the phenolic antioxidant also found in red grapes and red wine that is thought to be responsible for the French paradox: the fact that in France, people consume a diet that is not low in fat, but have a lower risk of cardiovascular disease compared to the U.S. With all of the important nutrients provided by nuts like peanuts, it is no wonder that numerous research studies, including the Nurses' Health Study that involved over 86,000 women, have found that frequent nut consumption is related to reduced risk of cardiovascular disease.

Peanuts Rival Fruit as a Source of Antioxidants

Not only do peanuts contain oleic acid, the healthful fat found in olive oil, but new research shows these tasty legumes are also as rich in antioxidants as many fruits.

While unable to boast an antioxidant content that can compare with the fruits highest in antioxidants, such as pomegranate, roasted peanuts do rival the antioxidant content of blackberries and strawberries, and are far richer in antioxidants than apples, carrots or beets. Research conducted by a team of University of Florida scientists, published in the journal *Food Chemistry*, shows that peanuts contain high concentrations of antioxidant polyphenols, primarily a compound called p-coumaric acid, and that roasting can increase peanuts' p-coumaric acid levels, boosting their overall antioxidant content by as much as 22%.

Peanuts' Antioxidants Key to their Heart-Health Benefits

Research published in the *British Journal of Nutrition* (Blomhoff R, Carlsen MH), which identified several nuts among plant foods with the highest total antioxidant content, suggests nut's high antioxidant content may be key to their cardio-protective benefits.

Nuts' high antioxidant content helps explain results seen in the Iowa Women's Health Study in which risk of death from cardiovascular and coronary heart diseases showed strong and consistent reductions with increasing nut/peanut butter consumption. Total death rates decreased 11% and 19% for nut/peanut butter intake once per week and 1-4 times per week, respectively.

Even more impressive were the results of a review study of the evidence linking nuts and lower risk of coronary heart disease, also published in the *British Journal of Nutrition*. (Kelly JH, Sabate J.) In this study, researchers looked at four large prospective epidemiological studies—the Adventist Health Study, Iowa Women's Study, Nurses' Health Study and the Physician's Health Study. When evidence from all four studies was combined, subjects consuming nuts at least 4 times a week showed a 37% reduced risk of coronary heart disease compared to those who never or seldom ate nuts. Each additional serving of nuts per week was associated with an average 8.3% reduced risk of coronary heart disease.

Practical Tip: To lower your risk of cardiovascular and coronary heart disease, enjoy a handful of peanuts or other nuts, or a tablespoon of nut butter, at least 4 times a week.

Potentially Reduced Risk of Stroke Based on Preliminary Animal Studies

Resveratrol is a flavonoid first studied in red grapes and red wine, but now also found to be present in peanuts. In animal studies on resveratrol itself (the purified nutrient given in intravenous form, not the food form), this phytonutrient has been determined to improve blood flow in the brain by as much as 30%, thus greatly reducing the risk of stroke, according to the results of a laboratory animal study published in the *Journal of Agricultural and Food Chemistry*.

Lead researcher Kwok Tung Lu hypothesized that resveratrol exerted this very beneficial effect by stimulating the production and/or release of nitric oxide (NO), a molecule made in the lining of blood vessels (the endothelium) that signals the surrounding muscle to relax, dilating the blood vessel and increasing blood flow. In the animals that received resveratrol, the concentration of nitric oxide (NO) in the affected part of the brain was 25% higher than that seen not only in the ischemia-only group, but even in the control animals.

The jury is still out on peanuts however, since they contain far less resveratrol than the amounts used in the above study, and also less than the amount provided by red wine. An ounce of red wine can provide as much as 1,000 micrograms of resveratrol, and it almost always provides over 75 micrograms. The same ounce of peanut butter can only provide about 50 micrograms of resveratrol. Still, routine consumption of peanuts or peanut butter might turn out to be significant in terms of the resveratrol provided by this food.

Peanuts Protective, but Pickled Foods Increase Risk of Colon Cancer

A number of studies have shown that nutrients found in peanuts, including folic acid, phytosterols, phytic acid (inositol hexaphosphate) and resveratrol, may have anti-cancer effects. A rich source all these nutrients—including the phytosterol beta-sisterol, which has demonstrated anti-cancer actions—peanuts have long been considered a likely candidate as a colon cancer-preventive food.(Awad AB, Chan KC, et al., *Nutr Cancer*)

Colorectal cancer is the second most fatal malignancy in developed countries and the third most frequent cancer worldwide. In Taiwan, not only has incidence of colon cancer increased, but the likelihood of dying from the disease rose 74% from 1993 to 2002.

Taiwanese researchers decided to examine peanuts' anti-colon cancer potential and conducted a 10-year study involving 12,026 men and 11,917 women to see if eating peanuts might affect risk of colon cancer.(Yeh CC, You SL, et al., *World J Gastroenterol*)

Researchers tracked study participants' weekly food intake, collecting data on frequently consumed foods and folk dishes such as sweet potato, bean products, peanut products, pickled foods, and foods that contained nitrates or were smoked.

Risk of colon cancer was found to be highly correlated with both peanuts, which greatly lessened risk, and pickled foods, which greatly increased risk, particularly in women.

Eating peanuts just 2 or more times each week was associated with a 58% lowered risk of colon cancer in women and a 27% lowered risk in men.

In women, but not in men, eating pickled foods 2 or more times a week more than doubled the likelihood of developing colon cancer risk for women, increasing their risk 215%.

Practical Tips: To help prevent colon cancer, avoid pickled foods, but enjoy peanuts at least twice each week. In addition to that old stand-by, the PB&J sandwich, try some of the following:

- Spread peanut butter on your morning waffle, whole grain toast or mid-morning crackers.
- Add a tablespoon of peanut butter to your morning smoothie.
- Enjoy a handful of dry roasted peanuts with a glass of tomato juice as an afternoon snack.
- Combine peanut butter, coconut milk, and ready-to-use Thai red or green curry paste for a quick, delicious sauce. Pour over healthy sautéed vegetables. Use as a cooking sauce for tofu or salmon.
- Toss cooked brown rice with sesame oil, chopped peanuts, scallions, sweet red pepper, parsley and currants.

When purchasing peanut butter, be sure to read the label. Hydrogenated(trans-) fats and sugar are often added to peanut butter. Buy organic and choose brands that contain peanuts, salt—and nothing else!

Help Prevent Gallstones

Twenty years of dietary data collected on over 80,000 women from the Nurses' Health Study shows that women who eat least 1 ounce of nuts, peanuts or peanut butter each week have a 25% lower risk of developing gallstones. Since 1 ounce is only 28.6 nuts or about 2 tablespoons of nut butter, preventing gallbladder disease may be as easy as packing one peanut butter and jelly sandwich (be sure to use whole wheat bread for its fiber, vitamins and minerals) for lunch each week, having a handful of peanuts as an afternoon pick me up, or tossing some peanuts on your oatmeal or salad.

Protect against Alzheimer's and Age-related Cognitive Decline

Research published in the *Journal of Neurology, Neurosurgery and Psychiatry* indicates regular consumption of niacin-rich foods like peanuts provides protection against Alzheimer's disease and age-related cognitive decline.

Researchers from the Chicago Health and Aging Project interviewed over 3,000 Chicago residents aged 65 or older about their diet, then tested their cognitive abilities over the following six years.

Those getting the most niacin from foods (22 mg per day) were 70% less likely to have developed Alzheimer's disease than those consuming the least (about 13 mg daily), and their rate of age-related cognitive decline was significantly less. One easy way to boost your niacin intake is to snack on a handful of peanuts—just a quarter cup provides about a quarter of the daily recommended intake for niacin (16 mg per day for men and 14 for women).

Eating Nuts *Lowers* Risk of Weight Gain

Although nuts are known to provide a variety of cardio-protective benefits, many avoid them for fear of weight gain. A prospective study published in the journal *Obesity* shows such fears are groundless. In fact, people who eat nuts at least twice a week are much *less* likely to gain weight than those who almost never eat nuts.

The 28-month study involving 8,865 adult men and women in Spain, found that participants who ate nuts at least two times per week were 31% less likely to gain weight than were participants who never or almost never ate nuts.

And, among the study participants who gained weight, those who never or almost never ate nuts gained more (an average of 424 g more) than those who ate nuts at least twice weekly.

Study authors concluded, "Frequent nut consumption was associated with a reduced risk of weight gain (5 kg or more). These results support the recommendation of nut consumption as an important component of a cardioprotective diet and also allay fears of possible weight gain."

Practical Tip: Don't let concerns about gaining weight prevent you from enjoying the delicious taste and many health benefits of nuts!

- Spread some nut butter on your morning toast or bagel.
- Remember how many great childhood lunches involved a peanut butter and jelly sandwich? Upgrade that lunchbox favorite by spreading organic peanut butter and concord grape jelly on whole wheat bread.
- Fill a celery stick with nut butter for an afternoon pick-me-up.
- Sprinkle a handful of nuts over your morning cereal, lunchtime salad, dinner's steamed vegetables.
- Or just enjoy a handful of lightly roasted nuts as a healthy snack.

Description

Peanuts are almost ubiquitous in the U.S. culture: baseball games, circus elephants, cocktail snacks, and the ever-popular peanut butter and jelly sandwich. Yet, contrary to what their name implies, technically, peanuts are not nuts. They are, in botanical fact, legumes and are related to other foods in the legume family including peas, lentils, chickpeas and other beans.

Peanuts grow in a very fascinating manner. They actually start out as an above ground flower that, due to its heavy weight, bends towards the ground. The flower eventually burrows underground, which is where the peanut actually matures.

The veined brown shell or pod of the peanut contains two or three peanut kernels. Each oval-shaped kernel or seed is comprised of two off-white lobes that are covered by a brownish-red skin. Peanuts have a hardy, buttery and "nutty" taste.

Peanuts go by various names throughout the world with "goober" or "goober pea" being one of the most popular. Goober is derived from *nguba,* the name for peanut in the Bantu language spoken in parts of Africa. Peanuts are known scientifically as *Arachis hypogaea*.

While there are many varieties of peanuts, the ones most commonly found in the marketplace are the Virginia, Spanish and Valencia. Due to their high protein content and chemical profile, peanuts are processed into a variety of different forms, including butter, oil, flour, and flakes.

History

Peanuts originated in South America where they have existed for thousands of years. They played an important role in the diet of the Aztecs and other Native Indians in South America and Mexico.

The Spanish and Portuguese explorers who found peanuts growing in the New World brought them on their voyages to Africa. They flourished in many African countries and were incorporated into local traditional food cultures. Since they were revered as a sacred food, they were placed aboard African boats traveling to North America during the beginning of the slave trade, which is how they were first introduced into this region.

In the 19th century, peanuts experienced a great gain in popularity in the U.S. thanks to the efforts of two specific people. The first was George Washington Carver, who not only suggested that farmers plant peanuts to replace their cotton fields that were destroyed by the boll weevil following the Civil War, but also invented more than 300 uses for this legume. At the end of the 19th century, a physician practicing in St. Louis, Missouri, created a ground up paste made from peanuts and prescribed this nutritious high protein, low carbohydrate food to his patients. While he may not have actually "invented" peanut butter since peanut paste had probably used by many cultures for centuries, his new discovery quickly caught on and became, and still remains, a very popular food.

Today, the leading commercial producers of peanuts are India, China, Nigeria, Indonesia and the United States.

How to Select and Store

Shelled peanuts are generally available in prepackaged containers as well as bulk bins. Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the peanuts are covered and that the store has a good product turnover so as to ensure the nuts' maximal freshness. Whether purchasing peanuts in bulk or in a packaged container, make sure that there is no evidence of moisture or insect damage. If it is possible to smell the peanuts, do so in order to ensure that they do not smell rancid or musty.

Whole peanuts still in their shell are usually available in bags or in the bulk bins. If possible, pick up a peanut and shake it, looking for two signs of quality. First, it should feel heavy for its size. Secondly, it should not rattle since a rattling sound suggests that the peanut kernels have dried out. Additionally, the shells should be free from cracks, dark spots and insect damage.

Shelled peanuts should be stored in a tightly sealed container in the refrigerator or freezer since excess exposure to heat, humidity or light will cause them to become rancid. Shelled peanuts will keep in the refrigerator for about three months and in the freezer for up to six months. They should not be chopped prior to storage, only right before eating or using in a recipe. Peanuts still in their shells can be kept in a cool, dry dark place, but keeping them in the refrigerator will extend their shelf life to about nine months.

How to Enjoy

A Few Quick Serving Ideas

- Sprinkle peanuts onto tossed salads.
- Add peanuts to healthy sautéed chicken and vegetables.
- Make a simple southeastern Asian salad by combining sliced green cabbage, grated ginger, Serrano chilis and peanuts. Toss with olive oil and soy sauce dressing.
- Instead of a peanut butter and jelly sandwich, try peanut butter and banana, peanut butter and honey, or peanut butter and chopped apple, pear and/or raisins.

Safety

Peanuts and Food Allergies

Peanuts are among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions.

Oxalate Content

Peanuts have consistently been determined to have high oxalate content. Oxalates are naturally occurring organic acids found in a wide variety of foods, and in the case of certain medical conditions, they must be greatly restricted in a meal plan to prevent over-accumulation inside the body. Our comprehensive article about oxalates will provide you with practical and detailed information about these organic acids, food, and health.

Peanuts and Aflatoxin

Peanuts are susceptible to molds and fungal invasions. Of particular concern is *aflatoxin*, a poison produced by a fungus called *Aspergillus flavus*. Although better storage and handling methods have virtually eliminated the risk of aflatoxin ingestion, aflatoxin is a known carcinogen that is twenty times more toxic than DDT and has also been linked to mental retardation and lowered intelligence. To help prevent aflatoxin ingestion, the U.S. Food and Drug Administration (FDA) also enforces a ruling that 20 parts per billion is the maximum of aflatoxin permitted in all foods and animal foods, including peanut butter and other peanut products. If purchasing raw peanuts, it is still wise to ensure that the peanuts have been stored in a dry, cool environment (the fungus grows when the temperature is between 86-96°F (30-36°C) and when the humidity is high). Roasted peanuts are thought to offer more protection against aflatoxin, plus roasting is also thought to improve peanuts' digestibility. If roasting peanuts at home, do so gently—in a 160-170°F (about 75°C) oven for 15-20 minutes—to preserve the healthy oils. For more on the effect of high heat roasting on nuts, please see the following I enjoy the flavor of roasted nuts but am concerned that roasting may make nuts more difficult to digest or may damage nuts' healthy fats, resulting in the production of free radicals and causing nuts to become rancid more rapidly. Should I be concerned or can nuts be roasted without affecting their healthy benefits?

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Peanuts, raw **0.25 cup** **36.50 grams**				**Calories: 207** **GI: low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
copper	0.42 mg	47	4.1	very good
manganese	0.71 mg	36	3.1	good

vitamin B3	4.40 mg	28	2.4	good
molybdenum	10.77 mcg	24	2.1	good
folate	87.60 mcg	22	1.9	good
biotin	6.40 mcg	21	1.9	good
vitamin E	3.04 mg (ATE)	20	1.8	good
phosphorus	137.24 mg	20	1.7	good
vitamin B1	0.23 mg	19	1.7	good
protein	9.42 g	19	1.6	good

World's Healthiest Foods Rating	**Rule**
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Pumpkin seeds

What's New and Beneficial About Pumpkin seeds

- Pumpkin seeds have long been valued as a source of the mineral zinc, and the World Health Organization recommends their consumption as a good way of obtaining this nutrient. If you want to maximize the amount of zinc that you will be getting from your pumpkin seeds, we recommend that you consider purchasing them in unshelled form. Although recent studies have shown there to be little zinc in the shell itself (the shell is also called the seed coat or husk), there is a very thin layer directly beneath the shell called the endosperm envelope, and it is often pressed up very tightly against the shell. Zinc is especially concentrated in this endosperm envelope. Because it can be tricky to separate the endosperm envelope from the shell, eating the entire pumpkin seed—shell and all—will ensure that all of the zinc-containing portions of the seed will be consumed. Whole roasted, unshelled pumpkin seeds contain about 10 milligrams of zinc per 3.5 ounces, and shelled roasted pumpkin seeds (which are often referred to pumpkin seed kernels) contain about 7-8 milligrams. So even though the difference is not huge, and even though the seed kernels remain a good source of zinc, you'll be able to increase your zinc intake if you consume the unshelled version.
- While pumpkin seeds are not a highly rich source of vitamin E in the form of alpha-tocopherol, recent studies have shown that pumpkin seeds provide us with vitamin E in a wide diversity of forms. From any fixed amount of a vitamin, we are likely to get more health benefits when we are provided with that vitamin in all of its different forms. In the case of pumpkin seeds, vitamin E is found in all of the following forms: alpha-tocopherol, gamma-tocopherol, delta-tocopherol, alpha-tocomonoenol, and gamma-tocomonoenol. These last two forms have only recently been discovered in pumpkin seeds, and their health benefits—including antioxidant benefits—are a topic of current interest in vitamin E research, since their bioavailability might be greater than some of the other vitamin E forms. The bottom line: pumpkin seeds' vitamin E content may bring us more health benefits that we would ordinarily expect due to the diverse forms of vitamin E found in this food.
- In our Tips for Preparing section, we recommend a roasting time for pumpkin seeds of no more than 15-20 minutes when roasting at home. This recommendation supported by a new study that pinpointed 20 minutes as a threshold time for changes in pumpkin seed fats. In this recent study, pumpkin seeds were roasted in a microwave oven for varying lengths of time, and limited changes in the pumpkin seeds fat were determined to occur under 20 minutes. However, when the seeds were roasted for longer than 20 minutes, a number of unwanted changes in fat structure were determined to occur more frequently.

Pumpkin Seeds, dried, shelled
0.25 cup
(32.25 grams)

Calories: 180
GI: low

Nutrient	DRI/DV
manganese	74%
phosphorus	57%
magnesium	48%
copper	48%
zinc	23%
protein	20%
iron	16%

Health Benefits

Antioxidant Support

While antioxidant nutrients are found in most WHFoods, it's the diversity of antioxidants in pumpkin seeds that makes them unique in their antioxidant support. Pumpkin seeds contain conventional antioxidant vitamins like vitamin E. However, not only do they contain vitamin E, but they contain it in a wide variety of forms. Alpha-tocopherol, gamma-tocopherol, delta-tocopherol, alpha-tocomonoenol and gamma-tocomonoenol are all forms of vitamin E found in pumpkin seeds. These last two forms have only recently been discovered, and they are a topic of special interest in vitamin E research, since their bioavailability might be greater than some of the other vitamin E forms. Pumpkin seeds also contain conventional mineral antioxidants like zinc and manganese. Phenolic antioxidants are found in pumpkin seeds in a wide variety of forms, including the phenolic acids hydroxybenzoic, caffeic, coumaric, ferulic, sinapic, protocatechuic, vanillic, and syringic acid. Antioxidant phytonutrients like lignans are also found in pumpkin seeds, including the lignans pinoresinol, medioresinol, and lariciresinol.

Interestingly, this diverse mixture of antioxidants in pumpkin seeds may provide them with antioxidant-related properties that are not widely found in food. For example, the pro-oxidant enzyme lipoxygenase (LOX) is known to be inhibited by pumpkin seed extracts, but not due to the presence of any single family of antioxidant nutrients (for example, the phenolic acids described earlier). Instead, the unique diversity of antioxidants in pumpkin seeds is most likely responsible for this effect.

Mineral Support

Plants that have a close relationship to the soil are often special sources of mineral nutrients, and pumpkin (and their seeds) are no exception. Our food rating process found pumpkin seeds to be a very good source of the minerals phosphorus, magnesium, manganese, and copper and a good source of the minerals zinc and iron.

Pumpkin seeds have long been valued as a special source of the mineral zinc, and the World Health Organization recommends their consumption as a good way of obtaining this nutrient. To get full zinc benefits from your pumpkin seeds, you may want to consume them in unshelled form. Although recent studies have shown there to be little zinc in the shell itself (the shell is also called the seed coat or husk), there is a very thin layer directly beneath the shell called the endosperm envelope, and it is often pressed up very tightly against the seed coat. Zinc is especially concentrated in this endosperm envelope. Because it can be tricky to separate the endosperm envelope from the shell, eating the entire pumpkin seed—shell and all—will ensure that all zinc-containing portions of the seed get consumed. Whole roasted, unshelled pumpkin seeds contain about 10 milligrams of zinc per 3.5 ounces, and shelled roasted pumpkin seeds (sometimes called pumpkin seed kernels) contain about 7-8 milligrams. So even though the difference is not huge, and even though the kernels still remain a good source of zinc, the unshelled version of this food is going to provide you with the best mineral support with respect to zinc.

Other Health Benefits

Diabetes

Most of the evidence we've seen about pumpkin seeds and prevention or treatment of diabetes has come from animal studies. For this reason, we consider research in this area to be preliminary. However, recent studies on laboratory animals have shown the ability of ground pumpkin seeds, pumpkin seed extracts, and pumpkin seed oil to improve insulin regulation in diabetic animals and to prevent some unwanted consequences of diabetes on kidney function. Decrease in oxidative stress has played a key role in many studies that show benefits of pumpkin seeds for diabetic animals.

Antimicrobial Benefits

Pumpkin seeds, pumpkin seed extracts, and pumpkin seed oil have long been valued for their anti-microbial benefits, including their anti-fungal and anti-viral properties. Research points to the role of unique proteins in pumpkin seeds as the source of many antimicrobial benefits. The lignans in pumpkin seeds (including pinoresinol, medioresinol, and lariciresinol) have also been shown to have antimicrobial—and especially anti-viral— properties. Impact of pumpkin seed proteins and pumpkin seed phytonutrients like lignans on the activity of a messaging molecule called interferon gamma (IFN-gamma) is likely to be involved in the antimicrobial benefits associated with this food.

Cancer-Related Benefits

Because oxidative stress is known to play a role in the development of some cancers, and pumpkin seeds are unique in their composition of antioxidant nutrients, it's not surprising to find some preliminary evidence of decreased cancer risk in association with pumpkin seed intake. However, the antioxidant content of pumpkin seeds has not been the focus of preliminary research in this cancer area. Instead, the research has focused on lignans. Only breast cancer and prostate cancer seem to have received much attention in the research world in connection with pumpkin seed intake, and much of that attention has been limited to the lignan content of pumpkin seeds. To some extent, this same focus on lignans has occurred in research on prostate cancer as well. For these reasons, we cannot describe the cancer-related benefits of pumpkin seeds as being well-documented in the research, even though pumpkin seeds may eventually be shown to have important health benefits in this area.

Possible Benefits for Benign Prostatic Hyperplasia (BPH)

Pumpkin seed extracts and oils have long been used in treatment of Benign Prostatic Hyperplasia (BPH). BPH is a health problem involving non-cancer enlargement of the prostate gland, and it commonly affects middle-aged and older men in the U.S. Studies have linked different nutrients in pumpkin seeds to their beneficial effects on BPH, including their phytosterols, lignans, and zinc. Among these groups, research on phytosterols is the strongest, and it centers on three phytosterols found in pumpkin seeds: beta-sitosterol, sitostanol, and avenasterol. The phytosterols campesterol, stigmasterol, and campestanol have also been found in pumpkin seeds in some studies. Unfortunately, studies on BPH have typically involved extracts or oils rather than pumpkin seeds themselves. For this reason, it's just not possible to tell whether everyday intake of pumpkin seeds in food form has a beneficial impact on BPH. Equally impossible to determine is whether intake of pumpkin seeds in food form can lower a man's risk of BPH. We look forward to future studies that will hopefully provide us with answers to those questions.

Description

Pumpkin seeds—also known as pepitas—are flat, dark green seeds. Some are encased in a yellow-white husk (often called the "shell"), although some varieties of pumpkins produce seeds without shells. Pumpkin seeds have a malleable, chewy texture and a subtly sweet, nutty flavor. While roasted pumpkins seeds are probably best known for their role as a perennial Halloween treat, these seeds are so delicious, and nutritious, that they can be enjoyed throughout the year. In many food markets, pepitas are available in all of the forms described above—raw and shelled, raw and unshelled, roasted and shelled, roasted and unshelled.

Like cantaloupe, watermelon, cucumber, and squash, pumpkins and pumpkin seeds belong to the gourd or *Cucurbitaceae* family. Within this family, the genus *Cucurbita* contains all of the pumpkins (and their seeds). The most common species of pumpkin used as a source of pumpkin seeds are *Cucurbita pepo*, *Cucurbita maxima*, *Cucurbita moschata*, and *Cucurbita mixta*.

History

Pumpkins, and their seeds, are native to the Americas, and indigenous species are found across North America, South America, and Central America. The word "pepita" is consistent with this heritage, since it comes from Mexico, where the Spanish phrase "pepita de calabaza" means "little seed of squash."

Pumpkin seeds were a celebrated food among many Native American tribes, who treasured them both for their dietary and medicinal properties. In South America, the popularity of pumpkin seeds has been traced at least as far back as the Aztec cultures of 1300-1500 AD. From the Americas, the popularity of pumpkin seeds spread to the rest of the globe through trade and exploration over many centuries. In parts of Eastern Europe and the Mediterranean (especially Greece), pumpkin seeds became a standard part of everyday cuisine, and culinary and medical traditions in India and other parts of Asia also incorporated this food into a place of importance.

Today, China produces more pumpkins and pumpkin seeds than any other country. India, Russia, the Ukraine, Mexico, and the U.S. are also major producers of pumpkin and pumpkin seeds. In the U.S., Illinois is the largest producer of pumpkins, followed by California, Ohio, Pennsylvania, Michigan, and New York. However, pumpkins are now grown commercially in virtually all U.S. states, and over 100,000 acres of U.S. farmland are planted with pumpkins.

How to Select and Store

Pumpkin seeds are generally available in prepackaged containers as well as bulk bins. Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the pumpkin seeds are covered and that the store has a good product turnover so as to ensure the seeds' maximal freshness. Whether purchasing pumpkin seeds in bulk or in a packaged container, make sure that there is no evidence of moisture or insect damage and that they are not shriveled. If it is possible to smell the pumpkin seeds, do so in order to ensure that they are not rancid or musty.

We recommend that you purchase certified organic raw pumpkin seeds and then light-roast them yourself (see next section on how to do so). By purchasing organic, you will avoid unnecessary exposure to potential contaminants. By purchasing raw, you will be able to control the roasting time and temperature, and avoid unnecessary damage to helpful fats present in the seeds. At the same time, you will be able to bring out the full flavors of the pumpkin seeds through roasting.

Pumpkin seeds should be stored in an airtight container in the refrigerator. While they may stay edible for several months, they seem to lose their peak freshness after about one to two months.

How to Enjoy

A Few Quick Serving Ideas

- Add pumpkin seeds to healthy sautéed vegetables.
- Sprinkle pumpkin seeds on top of mixed green salads.
- Grind pumpkin seeds with fresh garlic, parsley and cilantro leaves. Mix with olive oil and lemon juice for a tasty salad dressing.
- Add chopped pumpkin seeds to your favorite hot or cold cereal.
- Add pumpkin seeds to your oatmeal raisin cookie or granola recipe.
- Next time you make burgers, whether it be from vegetables, turkey or beef, add some ground pumpkin seeds.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Pumpkin Seeds, dried, shelled
0.25 cup
32.25 grams

Calories: 180
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
manganese	1.47 mg	74	7.3	very good
phosphorus	397.64 mg	57	5.7	very good
copper	0.43 mg	48	4.8	very good
magnesium	190.92 mg	48	4.8	very good
zinc	2.52 mg	23	2.3	good
protein	9.75 g	20	1.9	good
iron	2.84 mg	16	1.6	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Sesame seeds

Sesame seeds add a nutty taste and a delicate, almost invisible, crunch to many Asian dishes. They are also the main ingredients in tahini (sesame seed paste) and the wonderful Middle Eastern sweet call halvah. They are available throughout the year.

Sesame seeds may be the oldest condiment known to man. They are highly valued for their oil which is exceptionally resistant to rancidity. "Open sesame"—the famous phrase from the Arabian Nights—reflects the distinguishing feature of the sesame seed pod, which bursts open when it reaches maturity. The scientific name for sesame seeds is *Sesamun indicum*.

Sesame Seeds, dried
0.25 cup
(36.00 grams)

Calories: 206
GI: very low

Nutrient	DRI/DV
copper	163%
manganese	45%
calcium	35%
magnesium	32%
phosphorus	32%
iron	29%
zinc	25%
molybdenum	24%
selenium	23%
vitamin B1	23%
fiber	17%

Health Benefits

Not only are sesame seeds an excellent source of copper and a very good source of manganese, but they are also a good source of calcium, magnesium, iron, phosphorus, vitamin B1, zinc, molybdenum, selenium, and dietary fiber. In addition to these important nutrients, sesame seeds contain two unique substances: *sesamin* and *sesamolin*. Both of these substances belong to a group of special beneficial fibers called *lignans*, and have been shown to have a cholesterol-lowering effect in humans, and to prevent high blood pressure and increase vitamin E supplies in animals. Sesamin has also been found to protect the liver from oxidative damage.

Rich In Beneficial Minerals

Sesame seeds are an excellent source of copper, a very good source of manganese, and a good source of magnesium, calcium, phosphorus, iron, zinc, molybdenum, and selenium. This rich assortment of minerals translates into the following health benefits:

Copper Provides Relief for Rheumatoid Arthritis

Copper is known for its use in reducing some of the pain and swelling of rheumatoid arthritis. Copper's effectiveness is due to the fact that this trace mineral is important in a number of antiinflammatory and antioxidant enzyme systems. In addition, copper plays an important role in the activity of lysyl oxidase, an enzyme needed for the cross-linking of collagen and elastin—the ground substances that provide structure, strength and elasticity in blood vessels, bones and joints.

Magnesium Supports Vascular and Respiratory Health

Studies have supported magnesium's usefulness in:

- Preventing the airway spasm in asthma
- Lowering high blood pressure, a contributing factor in heart attack, stroke, and diabetic heart disease
- Preventing the trigeminal blood vessel spasm that triggers migraine attacks
- Restoring normal sleep patterns in women who are experiencing unpleasant symptoms associated with menopause

Calcium Helps Prevent Colon Cancer, Osteoporosis, Migraine and PMS

In recent studies, calcium has been shown to:

- Help protect colon cells from cancer-causing chemicals
- Help prevent the bone loss that can occur as a result of menopause or certain conditions such as rheumatoid arthritis
- Help prevent migraine headaches in those who suffer from them
- Reduce PMS symptoms during the luteal phase (the second half) of the menstrual cycle

There is a little bit of controversy about sesame seeds and calcium, because there is a substantial difference between the calcium content of hulled versus unhulled sesame seeds. When the hulls remain on the seeds, one tablespoon of sesame seeds will contains about 88 milligrams of calcium. When the hulls are removed, this same tablespoon will contain about 37 milligrams (about 60% less). Tahini—a spreadable paste made from ground sesame seeds—is usually made from hulled seeds (seeds with the hulls removed, called kernels), and so it will usually contain this lower amount of calcium.

The term "sesame butter" can sometimes refer to tahini made from sesame seed kernels, or it can also be used to mean a seed paste made from whole sesame seeds—hull included.

Although the seed hulls provide an additional 51 milligrams of calcium per tablespoon of seeds, the calcium found in the hulls appears in large part to be found in the form of calcium oxalate. This form of calcium is different than the form found in the kernels, and it is a less absorbable form of calcium. So even though a person would be likely to get more calcium from sesame seeds or sesame seed butter that contained the hulls, there is a question about how much more calcium would be involved. It would defintely be less than the 51 additional milligrams found in the seed hulls.

Zinc for Bone Health

Another reason for older men to make zinc-rich foods such as sesame seeds a regular part of their healthy way of eating is bone mineral density. Although osteoporosis is often thought to be a disease for which postmenopausal women are at highest risk, it is also a potential problem for older men. Almost 30% of hip fractures occur in men, and 1 in 8 men over age 50 will have an osteoporotic fracture. A study of 396 men ranging in age from 45-92 that was published in the *American Journal of Clinical Nutrition* found a clear correlation between low dietary intake of zinc, low blood levels of the trace mineral, and osteoporosis at the hip and spine.

Sesame Seeds' Phytosterols Lower Cholesterol

Phytosterols are compounds found in plants that have a chemical structure very similar to cholesterol, and when present in the diet in sufficient amounts, are believed to reduce blood levels of cholesterol, enhance the immune response and decrease risk of certain cancers.

Phytosterols beneficial effects are so dramatic that they have been extracted from soybean, corn, and pine tree oil and added to processed foods, such as "butter"-replacement spreads, which are then touted as cholesterol-lowering "foods." But why settle for an imitation "butter" when Mother Nature's nuts and seeds are a naturally rich source of phytosterols—and cardio-protective fiber, minerals and healthy fats as well?

In a study in the *Journal of Agricultural and Food Chemistry*, researchers published the amounts of phytosterols present in nuts and seeds commonly eaten in the United States.

Sesame seeds had the highest total phytosterol content (400-413 mg per 100 grams), and English walnuts and Brazil nuts the lowest (113 mg/100grams and 95 mg/100 grams). (100 grams is equivalent to 3.5 ounces.) Of the nuts and seeds typically consumed as snack foods, pistachios and sunflower seeds were richest in phytosterols (270-289 mg/100 g), followed by pumpkin seeds (265 mg/100 g).

Description

Sesame seeds are tiny, flat oval seeds with a nutty taste and a delicate, almost invisible crunch. They come in a host of different colors, depending upon the variety, including white, yellow, black and red.

Sesame seeds are highly valued for their high content of sesame oil, an oil that is very resistant to rancidity. Sesame seeds are the main ingredients in both tahini and the Middle Eastern sweet treat, halvah.

Open sesame—the famous phrase from the Arabian Nights—reflects the distinguishing feature of the sesame seed pod, which bursts open when it reaches maturity. The scientific name for sesame seeds is *Sesamun indicum*.

History

While sesame seeds have been grown in tropical regions throughout the world since prehistoric times, traditional myths hold that their origins go back even further. According to Assyrian legend, when the gods met to create the world, they drank wine made from sesame seeds.

These seeds were thought to have first originated in India and were mentioned in early Hindu legends. In these legends, tales are told in which sesame seeds represent a symbol of immortality. From India, sesame seeds were introduced throughout the Middle East, Africa and Asia.

Sesame seeds were one of the first crops processed for oil as well as one of the earliest condiments. The addition of sesame seeds to baked goods can be traced back to ancient Egyptian times from an ancient tomb painting that depicts a baker adding the seeds to bread dough.

Sesame seeds were brought to the United States from Africa during the late 17th century. Currently, the largest commercial producers of sesame seeds include India, China and Mexico.

How to Select and Store

Sesame seeds are generally available in prepackaged containers as well as bulk bins. Just as with any other food that you can purchase in the bulk section, make sure that the bins containing the sesame seeds are covered and that the store has a good product turnover to ensure maximal freshness.

Whether purchasing sesame seeds in bulk or in a packaged container, make sure there is no evidence of moisture. Additionally, since they have a high oil content and can become rancid, smell those in bulk bins to ensure that they smell fresh.

Unhulled sesame seeds can be stored in an airtight container in a cool, dry, dark place. Once the seeds are hulled, they are more prone to rancidity, so they should then be stored in the refrigerator or freezer.

How to Enjoy

A Few Quick Serving Ideas

- Add sesame seeds into the batter the next time you make homemade bread, muffins or cookies.
- Use the traditional macrobiotic seasoning, gomasio, to enliven your food. You can either purchase gomasio at a health food store or make your own by using a mortar and pestle. Simply mix together one part dry roasted sea salt with twelve parts dry roasted sesame seeds.
- Sesame seeds add a great touch to steamed broccoli that has been sprinkled with lemon juice.
- Spread tahini (sesame paste) on toasted bread and either drizzle with honey for a sweet treat or combine with miso for a savory snack.
- Combine toasted sesame seeds with rice vinegar, soy sauce and crushed garlic and use as a dressing for salads, vegetables and noodles.
- Healthy sauté chicken with sesame seeds, soy sauce, garlic, ginger and your favorite vegetables for a healthy, but quick, Asian-inspired dinner.

Safety

Sesame Seeds and Food Allergies

While not among the top eight food allergen groups in the United States, sesame seeds are a food that researchers have found to be associated with an increased prevalence of food allergy. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Sesame Seeds, dried
0.25 cup
36.00 grams

Calories: 206
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
copper	1.47 mg	163	14.3	excellent
manganese	0.89 mg	45	3.9	very good
calcium	351.00 mg	35	3.1	good
phosphorus	226.44 mg	32	2.8	good
magnesium	126.36 mg	32	2.8	good
iron	5.24 mg	29	2.5	good
zinc	2.79 mg	25	2.2	good
molybdenum	10.62 mcg	24	2.1	good
vitamin B1	0.28 mg	23	2.0	good
selenium	12.38 mcg	23	2.0	good
fiber	4.25 g	17	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Sunflower seeds

Looking for a health-promoting snack? Enjoy a handful of mild nutty tasting sunflower seeds with their firm but tender texture to take care of your hunger and get a wealth of nutrition at the same time. Sunflower seeds are available at your local market throughout the year.

Sunflower seeds are the gift of the beautiful sunflower that has rays of petals emanating from its bright yellow, seed-studded center. The flower produces grayish-green or black seeds encased in tear-dropped shaped gray or black shells that oftentimes feature black and white stripes. Since these seeds have a very high oil content, they are one of the main sources of polyunsaturated oil.

Sunflower Seeds, dried
0.25 cup
(35.00 grams)

Calories: 204
GI: low

Nutrient	DRI/DV
vitamin E	82%
copper	70%
vitamin B1	43%
manganese	34%
selenium	34%
phosphorus	33%
magnesium	28%
vitamin B6	28%
folate	20%
vitamin B3	18%

Health Benefits

Looking for a health-promoting snack? A handful of sunflower seeds will take care of your hunger, while also enhancing your health by supplying significant amounts of vitamin E, magnesium and selenium.

Anti-Inflammatory and Cardiovascular Benefits from Sunflower Seeds' Vitamin E

Sunflower seeds are an excellent source of vitamin E, the body's primary fat-soluble antioxidant. Vitamin E travels throughout the body neutralizing free radicals that would otherwise damage fat-containing structures and molecules, such as cell membranes, brain cells, and cholesterol. By protecting these cellular and molecular components, vitamin E has significant anti-inflammatory effects that result in the reduction of symptoms in asthma, osteoarthritis, and rheumatoid arthritis, conditions where free radicals and inflammation play a big role. Vitamin E has also been shown to reduce the risk of colon cancer, help decrease the severity and frequency of hot flashes in women going through menopause, and help reduce the development of diabetic complications.

In addition, vitamin E plays an important role in the prevention of cardiovascular disease. Vitamin E is one of the main antioxidants found in cholesterol particles and helps prevent free radicals from oxidizing cholesterol. Only after it has been oxidized is cholesterol able to adhere to blood vessel walls and initiate the process of atherosclerosis, which can lead to blocked arteries, heart attack, or stroke. Getting plenty of vitamin E can significantly reduce the risk of developing atherosclerosis. In fact, studies show that people who get a good amount of vitamin E are at a much lower risk of dying of a heart attack than people whose dietary intake of vitamin E is marginal or inadequate.

Sunflower Seeds' Phytosterols Lower Cholesterol

Phytosterols are compounds found in plants that have a chemical structure very similar to cholesterol, and when present in the diet in sufficient amounts, are believed to reduce blood levels of cholesterol, enhance the immune response and decrease risk of certain cancers.

Phytosterols beneficial effects are so dramatic that they have been extracted from soybean, corn, and pine tree oil and added to processed foods, such as "butter"-replacement spreads, which are then touted as cholesterol-lowering "foods." But why settle for an imitation "butter" when Mother Nature's nuts and seeds are a naturally rich source of phytosterols—and cardio-protective fiber, minerals and healthy fats as well?

In a study in the *Journal of Agricultural and Food Chemistry*, researchers published the amounts of phytosterols present in nuts and seeds commonly eaten in the United States.

Sesame seeds had the highest total phytosterol content (400-413 mg per 100 grams), and English walnuts and Brazil nuts the lowest (113 mg/100grams and 95 mg/100 grams). (100 grams is equivalent to 3.5 ounces.) Of the nuts and seeds typically consumed as snack foods, sunflower seeds and pistachios were richest in phytosterols (270-289 mg/100 g), followed by pumpkin seeds (265 mg/100 g).

Calm Your Nerves, Muscles and Blood Vessels with Sunflower Seeds' Magnesium

Sunflower seeds are a good source of magnesium. Numerous studies have demonstrated that magnesium helps reduce the severity of asthma, lower high blood pressure, and prevent migraine headaches, as well as reducing the risk of heart attack and stroke.

Magnesium is also necessary for healthy bones and energy production. About two-thirds of the magnesium in the human body is found in our bones. Some helps give bones their physical structure, while the rest is found on the surface of the bone where it is stored for the body to draw upon as needed.

Magnesium counterbalances calcium, thus helping to regulate nerve and muscle tone. In many nerve cells, magnesium serves as Nature's own calcium channel blocker, preventing calcium from rushing into the nerve cell and activating the nerve. By blocking calcium's entry, magnesium keeps our nerves (and the blood vessels and muscles they ennervate) relaxed. If our diet provides us with too little magnesium, however, calcium can gain free entry, and the nerve cell can become overactivated, sending too many messages and causing excessive contraction. Insufficient magnesium can thus contribute to high blood pressure, muscle spasms (including spasms of the heart muscle or the spasms of the airways symptomatic of asthma), and migraine headaches, as well as muscle cramps, tension, soreness and fatigue.

Improved Detoxification and Cancer Prevention from Sunflower Seeds' Selenium

Sunflower seeds are also a good source of selenium, a trace mineral that is of fundamental importance to human health. Accumulated evidence from prospective studies, intervention trials and studies on animal models of cancer has suggested a strong inverse correlation between selenium intake and cancer incidence. Selenium has been shown to induce DNA repair and synthesis in damaged cells, to inhibit the proliferation of cancer cells, and to induce their apoptosis, the self-destruct sequence the body uses to eliminate worn out or abnormal cells.

In addition, selenium is incorporated at the active site of many proteins, including *glutathione peroxidase*, which is particularly important for cancer protection. One of the body's most powerful antioxidant enzymes, glutathione peroxidase is used in the liver to detoxify a wide range of potentially harmful molecules. When levels of glutathione peroxidase are too low, these toxic molecules are not disarmed and wreak havoc on any cells with which they come in contact, damaging their cellular DNA and promoting the development of cancer cells. Its selenium richness is another reason that sunflower seeds can make a good snack.

Description

Sunflower seeds are the gift of the beautiful sunflower, a plant with rays of petals emanating from its bright yellow, seed-studded center. The sunflower's Latin scientific name, *Helianthus annuus*, reflects its solar appearance since *helios* is the Greek word for sun, and *anthos* is the Greek word for flower.

The sunflower produces grayish-green or black seeds encased in tear-dropped shaped gray or black shells that oftentimes feature black and white stripes. Since these seeds have a very high oil content, they are one of the main sources used to produce polyunsaturated oil. Shelled sunflower seeds have a mild nutty taste and firm, but tender texture. Their taste is oftentimes compared with the Jerusalem artichoke (not to be confused with the bulb artichoke), another member of the *Helianthus* family.

History

While sunflowers are thought to have originated in Mexico and Peru, they are one of the first plants to ever be cultivated in the United States. They have been used for more than 5,000 years by the Native Americans, who not only used the seeds as a food and an oil source, but also used the flowers, roots and stems for varied purposes including as a dye pigment. The Spanish explorers brought sunflowers back to Europe, and after being first grown in Spain, they were subsequently introduced to other neighboring countries. Currently, sunflower oil is one of the most popular oils in the world. Today, the leading commercial producers of sunflower seeds include the Russian Federation, Peru, Argentina, Spain, France and China.

How to Select and Store

Sunflower seeds are sold either shelled or unshelled and are generally available in prepackaged containers as well as bulk bins. Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the sunflower seeds are covered and that the store has a good product turnover so as to ensure the seeds' maximal freshness.

When purchasing unshelled seeds, make sure that the shells are not broken or dirty. Additionally, they should be firm and not have a limp texture. When purchasing shelled seeds, avoid those that appear yellowish in color as they have probably gone rancid. In addition, if you are purchasing sunflower seeds from a bulk bin, smell them to ensure that they are still fresh and have not spoiled.

Since sunflower seeds have a high fat content and are prone to rancidity, it is best to store them in an airtight container in the refrigerator. They can also be stored in the freezer since the cold temperature will not greatly affect their texture or flavor.

How to Enjoy

A Few Quick Serving Ideas

- Add sunflower seeds to your favorite tuna, chicken or turkey salad recipe.
- Garnish mixed green salads with sunflower seeds.
- Adding sunflower seeds to scrambled eggs will give them a unique taste and texture.
- Use fine ground sunflower seeds to dust your meats with in place of flour.
- Sprinkle sunflower seeds onto hot and cold cereals.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Sunflower Seeds, dried **0.25 cup** **35.00 grams**				**Calories: 204** **GI: low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin E	12.31 mg (ATE)	82	7.2	excellent
copper	0.63 mg	70	6.2	very good
vitamin B1	0.52 mg	43	3.8	very good
manganese	0.68 mg	34	3.0	good
selenium	18.55 mcg	34	3.0	good

phosphorus	231.00 mg	33	2.9	good
magnesium	113.75 mg	28	2.5	good
vitamin B6	0.47 mg	28	2.4	good
folate	79.45 mcg	20	1.7	good
vitamin B3	2.92 mg	18	1.6	good

World's Healthiest Foods Rating	**Rule**
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Walnuts

What's New and Beneficial about Walnuts

- Researchers are convinced—more than ever before—about the nutritional benefits of walnuts when consumed in whole form, including the skin. We now know that approximately 90% of the phenols in walnuts are found in the skin, including key phenolic acids, tannins, and flavonoids. Some websites will encourage you to remove the walnut skin—that whitish, sometimes waxy, sometimes flaky, outermost part of shelled walnuts. There can be slight bitterness to this skin, and that's often the reason that websites give for removing it. However, we encourage you not to remove this phenol-rich portion.
- The form of vitamin E found in walnuts is somewhat unusual, and particularly beneficial. Instead of having most of its vitamin E present in the alpha-tocopherol form, walnuts provide an unusually high level of vitamin E in the form of gamma-tocopherol. Particularly in studies on the cardiovascular health of men, this gamma-tocopherol form of vitamin E has been found to provide significant protection from heart problems.
- Most U.S. adults have yet to discover the benefits of walnuts. A recent study has determined that only 5.5% of all adults (ages 19-50) consume tree nuts of any kind! This small percentage of people actually do a pretty good job of integrating tree nuts (including walnuts) into their diet, and average about 1.25 ounces of tree nuts per day. But the other 94.5% of us report no consumption of tree nuts whatsoever. In a recent look at the nutritional differences between tree nut eaters and non-eaters, researchers have reported some pretty notable findings: on a daily average, tree nut eaters take in 5 grams more fiber, 260 milligrams more potassium, 73 more milligrams of calcium, 95 more milligrams of magnesium, 3.7 milligrams more vitamin E, and 157 milligrams less sodium!
- Many of us can go local for our supply of walnuts. According to the latest trade statistics, 38% of all walnuts are grown in the U.S. Of that 38%, the vast majority (almost 90%) come from California, and particularly from the San Joaquin and Sacramento Valleys. Buying walnuts closer to home can provide great benefits from the standpoint of sustainability.
- Phytonutrient research on the antioxidant and anti-inflammatory benefits of walnuts has moved this food further and further up the ladder of foods that are protective against metabolic syndrome, cardiovascular problems, and type 2 diabetes. Some phytonutrients found in walnuts—for example, the quinone juglone—are found in virtually no other commonly-eaten foods. Other phytonutrients—like the tannin tellimagrandin or the flavonol morin—are also rare and valuable as antioxidants and anti-inflammatory nutrients. These anti-inflammatory and antioxidant phytonutrients also help explain the decreased risk of certain cancers—including prostate cancer and breast cancer—in relationship to walnut consumption.

WHFoods Recommendations

Walnuts are part of the tree nut family. This food family includes Brazil nuts, cashews, hazelnuts (filberts), macadamia nuts, pecans, pine nuts, pistachios and walnuts. It would be difficult to overestimate the potential health benefits associated with this food family! In the majority of dietary studies, approximately one ounce of tree nuts per day is the minimal amount needed to provide statistically significant benefits, and that's the amount we recommend that you incorporate into your daily diet. In the case of walnuts, one ounce means about 7 shelled walnuts, or 14 walnut halves. Of course, since tree nuts (including walnuts) are a high-calorie food, it's important to incorporate tree nuts into an overall healthy diet that remains on target in terms of calories. Luckily, research has shown that many people are able to take this step with good success in terms of overall caloric intake.

Walnuts not only taste great but are a rich source of heart-healthy monounsaturated fats and an excellent source of those hard to find omega-3 fatty acids. Like most nuts, they can easily be added to your Healthiest Way of Eating. Just chop and add to your favorite salad, vegetable dish, fruit, or dessert.

Walnuts, English, dried pieces
0.25 cup
(30.00 grams)

Calories: 196
GI: low

Nutrient	DRI/DV
omega-3 fats	113%
copper	53%
manganese	51%
molybdenum	20%
biotin	19%

Health Benefits

Cardiovascular Benefits

No aspect of walnuts has been better evaluated in the research than their benefits for the heart and circulatory system. Some review studies have emphasized the very favorable impact of walnuts on "vascular reactivity," namely, the ability of our blood vessels to respond to various stimuli in a healthy manner. In order to respond to different stimuli in a healthy way, many aspects of our cardiovascular system must be functioning optimally. These aspects include: ample presence of antioxidant and anti-inflammatory nutrients, proper blood composition, correct balance in inflammation-regulating molecules, and proper composition and flexibility in our blood vessel walls. Researchers have determined the ability of walnuts to have a favorable impact on *all* of these aspects. The chart below summarizes some key research findings about walnuts and heart health:

Cardiovascular Aspect	**Walnut Benefit**
Blood Quality	decreased LDL cholesterol; decreased total cholesterol; increased gamma-tocopherol; increased omega-3 fatty acids in red blood cells (alpha-linolenic acid)
Vasomotor Tone	decreased aortic endothelin; improved endothelial cell function
Risk of Excessive Clotting	decreased maximum platelet aggregation rate; decreased platelet activation
Risk of Excessive Inflammation	decreased C reactive protein (CRP); decreased tumor necrosis factor alpha (TNF-a)

Research on the blood pressure benefits of walnuts has been mixed. We suspect that these mixed results are related to the surprising differences in mineral composition amongst different varieties of walnuts. Researchers have long been aware of the relationship between healthy blood pressure and intake of specific minerals, including potassium, calcium, and magnesium. In multiple studies, these minerals have a much greater impact on blood pressure than the mineral sodium (familiar to most people in its sodium chloride form, i.e., everyday table salt). We've seen studies showing the following ranges for key blood pressure-regulating minerals in walnuts:

Mineral	**Natural Range Found Amongst Different Walnut Varieties (milligrams per 100 grams)**
Potassium	375-500
Calcium	13-91
Magnesium	189-278

Even though there are valuable amounts of these blood pressure-regulating minerals in virtually all varieties of walnuts, the ranges above may help explain why some studies have shown statistically significant benefits from walnuts on blood pressure while others have not.

Not in question with respect to walnuts and cardiovascular support is their reliable omega-3 content. Adequate intake of omega-3s, including the alpha-linolenic acid (ALA) present in walnuts, has repeatedly been shown to help improve a wide variety of cardiovascular functions, including blood pressure. In at least one research study, adults have been able to significantly increase their blood level of ALA with as few as 4 walnuts per day.

Walnuts Help Reduce Problems in Metabolic Syndrome

In the United States, as many as 1 in 4 adults may be eligible for diagnosis with Metabolic Syndrome (MetS). MetS isn't so much a "disease" as a constellation of problematic and overlapping metabolic problems including excessive blood fats (triglycerides), high blood pressure, inadequate HDL cholesterol, and obesity (as measured by waist circumference, and/or body mass index). Recent studies have shown that approximately one ounce of walnuts daily over a period of 2-3 months can help reduce several of these MetS-related problems. In addition, addition of walnuts to participant diets has also been shown to decrease "abdominal adiposity"—the technical term for the depositing of fat around the mid-section. Importantly, the MetS benefits of added walnuts have been achieved without causing weight gain in any the studies we've seen to date.

Benefits in Treatment of Type 2 Diabetes

Although we think about type 2 diabetes as a problem primarily related to blood sugar control and insulin metabolism, persons diagnosed with type 2 diabetes typically have health problems in other related systems, and are at special risk for cardiovascular problems. An important part of the goal in designing a diet plan for persons with type 2 diabetes is lowering the risk of future cardiovascular problems. In this context, consumption of walnuts is establishing a more and more impressive research track record. Increased flexibility in the response of the cardiovascular system following meals has been a repeated finding in research on walnuts. A variety of different measurements on blood vessel functioning (including their measurement by ultrasound) show a relatively small amount of daily walnut intake (1-2 ounces) to provide significant benefits in this area for persons with type 2 diabetes. Better blood fat composition (including less LDL cholesterol and less total cholesterol) has also been demonstrated in persons with type 2 diabetes.

Anti-Cancer Benefits

Given the wide variety antioxidant and anti-inflammatory nutrients found in walnuts, it's not surprising to see research on this tree nut showing measurable anti-cancer benefits. The antioxidant properties of walnuts help lower risk of chronic oxidative stress, and the anti-inflammatory properties help lower risk of chronic inflammation, and it is precisely these two types of risk, that, when combined, pose the greatest threat for cancer development. Prostate cancer and breast cancer are the best-studied types of cancer with respect to walnut intake, and their risk has been found to be reduced by fairly large amounts of walnut consumption. (Large in this case means approximately 3 ounces per day.) For prostate cancer, the evidence is somewhat stronger, and more studies have involved human subjects. For breast cancer, most of the evidence has been based on studies of rats and mice.

Other Health Benefits

The anti-inflammatory nutrients in walnuts may play a special role in support of bone health. A recent study has shown that large amounts of walnuts decrease blood levels of N-telopeptides of type 1 collagen (NTx). These collagen components provide a good indicator of bone turnover, and their decreased blood level in response to walnut intake is an indication of better bone stability and less mineral loss from the bone. "Large amounts" of walnuts (in this study, actually raw walnuts plus walnut oil) translated into 50% of total dietary fat. In an everyday diet that provided 2,000 calories and 30% of those calories from fat, this 50% standard for walnuts would mean about 67 grams of fat from walnuts or 4 ounces of this tree nut on a daily basis. While this amount is more than would most people would ordinarily consume, we expect the health benefits of walnuts for bone health to be demonstrated in future studies at substantially lower levels of intake.

Walnuts have also produced a good track record in the research as a desirable food for support of weight loss and for prevention of obesity. That finding often surprises people because they think of high-fat, high-calorie foods as a primary contributing factor to obesity and to weight gain. In general, overconsumption of high-fat, high-calorie foods is a primary contributing factor to obesity and weight gain. However, obesity has also been clearly identified by researchers as involving chronic, unwanted inflammation. As discussed earlier in this Health Benefits section and throughout this walnuts' profile, walnuts are unique in their collection of anti-inflammatory nutrients. These nutrients include omega-3 fatty acids; phytonutrients including tannins, phenolic acids, and flavonoids; quinones like juglone; and other anti-inflammatory phytonutrients. These anti-inflammatory benefits can overshadow the high-calorie and high-fat risk posed by walnuts, and that's exactly what they have done in an increasing number of research studies involving risk and/or treatment of obesity. While it is definitely possible to overconsume walnuts, most everyday diets could remain correctly balanced in terms of calories and fat while still including fairly generous amounts of walnuts (in the range of 1-3 ounces).

A limited (but increasing) number of studies have shown potential health benefits for walnuts in the area of memory and general thought processes (often referred to as "cognitive" processes). Thus far, most of the initial research in this area has involved rats and mice, but we expect to see cognitive benefits of walnuts for humans becoming a topic of increasing research interest.

A final fascinating aspect of walnuts and their potential health benefits involves melatonin (MLT). MLT is a widely-active messaging molecule in our nervous system, and very hormone-like in its regulatory properties. MLT is critical in the regulation of sleep, daily (circadian) rhythms, light-dark adjustment, and other processes. It has also been found to be naturally occurring within walnuts. Average melatonin (MLT) content of walnuts is approximately 3.6 nanograms (ng) per gram (g), or 102ng/ounce. Other commonly eaten foods—for example, cherries—have also been found to measurable amounts of MLT. Researchers are not yet sure how everyday intake of MLT from walnuts is involved in our health, but several study authors have hypothesized about the MLT in walnuts as playing an important role (along with other walnut nutrients) in the anti-cancer benefits of this unusual food.

Description

Walnuts are a delicious way to add extra nutrition, flavor and crunch to a meal. While walnuts are harvested in December, they are available year round and a great source of those all-important omega-3 fatty acids.

It is no surprise that the regal and delicious walnut comes from an ornamental tree that is highly prized for its beauty. The walnut kernel consists of two bumpy lobes that look like abstract butterflies. The lobes are off white in color and covered by a thin, light brown skin. They are partially attached to each other. The kernels are enclosed in round or oblong shells that are brown in color and very hard.

While there are numerous species of walnut trees, three of the main types of walnuts consumed are the English (or Persian) walnut, Juglans regia; the black walnut, Juglans nigra; and the white (or butternut) walnut, Juglans cinerea. The English walnut is the most popular type in the United States and features a thinner shell that is easily broken with a nutcracker. The black walnut has thicker shells that are harder to crack and a much more pungent distinctive flavor. The white walnut features a sweeter and oilier taste than the other two types, although it is not as widely available and therefore may be more difficult to find in the marketplace. Within these basic types of walnuts, there are dozens of different varieties (also called cultivars). It's not uncommon to see research studies that evaluate several dozen different cultivars of English or black walnuts. All types and varieties of walnuts can have unique nutrient composition. Sometimes within a particular type of walnut—for example, English walnut—there is a surprising amount of nutritional variety. The bottom line here is to not to get caught up in thinking that one main type of walnut (for example, English versus black) is best, but to take advantage of the nutritional variety offered by walnuts overall.

History

While walnut trees have been cultivated for thousands of years, the different types have varying origins. The English walnut originated in India and the regions surrounding the Caspian Sea, hence it is known as the Persian walnut. In the 4th century AD, the ancient Romans introduced the walnut into many European countries where it has been grown since. Throughout its history, the walnut tree has been highly revered; not only does it have a life span that is several times that of humans, but its uses include food, medicine, shelter, dye and lamp oil. It is thought that the walnuts grown in North America gained the moniker "English walnuts," since they were introduced into America via English merchant ships.

Black walnuts and white walnuts are native to North America, specifically the Central Mississippi Valley and Appalachian area. They played an important role in the diets and lifestyles of both the Native American Indians and the early colonial settlers.

China is presently the largest commercial producer of walnuts in the world, with about 360,000 metric tons produced per year. The United States is second, with about 294,000 metric tons of production. Within the U.S., about 90% of all walnuts are grown in California, particularly within the San Joaquin and Sacramento Valleys The annual combined walnut output of Iran and Turkey is approximately the same as the United States, and the Ukraine and Romania are next in line in terms of total walnut production.

How to Select and Store

When purchasing whole walnuts that have not been shelled choose those that feel heavy for their size. Their shells should not be cracked, pierced or stained, as this is oftentimes a sign of mold development on the nutmeat, which renders it unsafe for consumption.

Shelled walnuts are generally available in prepackaged containers as well as bulk bins. Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the walnuts are covered and that the store has a good product turnover so as to ensure its maximal freshness. Whether purchasing walnuts in bulk or in a packaged container avoid those that look rubbery or shriveled. If it is possible to smell the walnuts, do so in order to ensure that they are not rancid.

Due to their high polyunsaturated fat content, walnuts are extremely perishable and care should be taken in their storage. Shelled walnuts should be stored in an airtight container and placed in the refrigerator, where they will keep for six months, or the freezer, where they will last for one year. Unshelled walnuts should preferably be stored in the refrigerator, although as long as you keep them in a cool, dry, dark place they will stay fresh for up to six months.

How to Enjoy

A Few Quick Serving Ideas

- Mix crushed walnuts into plain yogurt and top with maple syrup.
- Add walnuts to salads or healthy sautéed vegetables.
- Purée walnuts, cooked lentils and your favorite herbs and spices in a food processor. Add enough olive or flax oil so that it achieves a dip-like consistency.
- Add walnuts to your favorite poultry stuffing recipe.
- To roast walnuts at home, do so gently—in a 160-170°F (about 75°C) oven for 15-20 minutes—to preserve the healthy oils. For more on the effect of high heat roasting on nuts, please see the following article.
- Make homemade walnut granola: Mix together approximately 1/2 cup of honey, 3 to 4 tablespoons of blackstrap molasses, a tablespoon of vanilla, a dash of salt, and a teaspoon each of your favorite spices, such as cinnamon, ginger and/or nutmeg. Place 6-8 cups of rolled oats in a large bowl and toss to coat with the honey-blackstrap mixture. Then spread on a cookie sheet and bake at 275°F (135°C) for 45 minutes. Cool and mix in 1/2 to 1 cup of walnuts.

WHFoods Recipes That Include Walnuts

- 10-Minute Energizing Oatmeal
- Hot Polenta Breakfast with Dried Fruit Compote
- Millet with Dried Fruit Compote
- Perfect Oatmeal
- Prunes in Orange Sauce
- Healthy Caesar Salad
- Healthy Chef's Salad with Walnuts and French Dressing
- Tuna Salad Surprise
- Broiled Rosemary Chicken over Pureed Lentils
- Holiday Turkey with Rice Stuffing & Gravy with Fresh Herbs
- Quick Broiled Chicken Breast with Honey-Mustard Sauce
- Mediterranean Lentil Salad
- Arugula Salad with Walnut Croutons
- Creamy Romaine Salad
- Figs, Walnuts and Spinach Salad
- Roasted Beets
- Wild Rice Pilaf
- 5-Minute Fresh Plums in Sweet Sauce
- Apricot Tart
- Blackberry Tart
- Cranberry and Fresh Pear Cobbler
- No-Bake Apple Walnut Tart
- Sesame Bar

Safety

Walnuts and Food Allergies

Tree nuts, such as walnuts, are among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Walnuts, English, dried pieces
0.25 cup
30.00 grams

Calories: 196
GI: low

Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
omega-3 fats	2.72 g	113	10.4	excellent
copper	0.48 mg	53	4.9	very good
manganese	1.02 mg	51	4.7	very good
molybdenum	8.85 mcg	20	1.8	good
biotin	5.70 mcg	19	1.7	good

World's Healthiest Foods Rating	**Rule**
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Black beans

What's New and Beneficial About Black Beans

- Recent research has shown that black beans provide special support for digestive tract health, and particularly our colon. The indigestible fraction (IF) in black beans has recently been shown to be larger than the IF in either lentils or chickpeas. It has been shown to be the perfect mix of substances for allowing bacteria in the colon to produce butyric acid. Cells lining the inside of the colon can use this butyric acid to fuel their many activities and keep the lower digestive tract functioning properly. By delivering a greater amount of IF to the colon, black beans are able to help support this lower part of our digestive tract. Lowered colon cancer risk that is associated with black bean intake in some research studies may be related to the outstanding IF content of this legume.

- The soaking of black beans in water has always found fairly widespread support in food science research as a way of improving overall black bean benefits. Yet, the discarding of the bean soaking water has been a topic of considerable controversy. A recent study that may help put this controversy to rest looked at many different advantages and disadvantages of tossing out the water used to soak beans. It found that the advantages clearly outweigh the disadvantages. On the advantage side of things, getting rid of the soaking water also means getting rid of some of the phytates and tannins that can lower nutrient availability. It also means reducing flatulence-related substances like raffinose (up to 33% removed along with the soaking water) and stachyose (up to 20% removed). A final advantage was the retention of resistant starch. While some of the total carbohydrate content in the black beans was lost along with the discarding of the soaking water, the amount of resistant starch remained unchanged. (Resistant starch is a type of carb that will typically make its way all the way down to the large intestine without being digested. Once it arrives in the large intestine, it can help support the growth of desirable bacteria in that area of the digestive tract.) On the disadvantage side of things was that 15% of total phenols were lost, we actually don't think that that is an amount that is of concern. There was a slight loss of some additional phytonutrients as well as minerals. When adding up all of their findings, the researchers concluded that the many advantages of discarding bean soaking water clearly outweighed the disadvantages and then made this recommendation a firm part of their research conclusions.

- We tend to think about brightly colored fruits and vegetables as our best source of phytonutrients, but recent research has recognized black beans as a strong contender in phytonutrient benefits. The seed coat of the black bean (the outermost part that we recognize as the bean's surface) is an outstanding source of three anthocyanin flavonoids: delphinidin, petunidin, and malvidin. These three anthocyanins are primarily responsible for the rich black color that we see on the bean surface. Kaempferol and quercetin are additional flavonoids provided by this legume. Also contained in black beans are hydroxycinnamic acids including ferulic, sinapic, and chlorogenic acid, as well as numerous triterpenoids.

- In Brazil—a country that, along with India, grows more black beans than any country in the world— beans have been given an exclusive place on the Brazilian Food Pyramid. In other words, beans are recommended as their own unique food group! The country's 2006 Food Guide for the Brazilian Population recommends that beans be consumed at least once every day. That recommendation is actually quite close to the Dietary Guidelines for Americans, which establish 3 cups of cooked legumes per week, or 1/2 cup serving six days per week, as the minimum desired amount. Recent research linking bean intake to lower risk of type 2 diabetes, many types of cardiovascular disease, and several types of cancer was one of the key factors used by the Brazilian government and the U.S. government in establishing their bean intake recommendations.

WHFoods Recommendations

Many public health organizations--including the American Diabetes Association, the American Heart Association, and the American Cancer Society--recommend legumes as a key food group for preventing disease and optimizing health. The 2005 Dietary Guidelines for Americans developed by the U.S. Department of Health and Human Services (USDHHS) and the U.S. Department of Agriculture (USDA) recommends 3 cups of legumes per week (based on a daily intake of approximately 2,000 calories). Because 1 serving of legumes was defined as 1/2 cup (cooked), the Dietary Guidelines for Americans come very close to the recommendation of 1/2 cup of cooked legumes on a daily basis. Based on our own research review, we believe that 3 cups of legumes per week is a very reasonable goal for support of good health. However, we also believe that optimal health benefits from legumes may require consumption in greater amounts. These greater amounts are based on studies in which legumes have been consumed at least 4 days per week and in amounts falling into a 1-2 cup range per day. These studies suggest a higher optimal health benefit level than the 2005 Dietary Guidelines: instead of 3 cups of weekly legumes, 4-8 cups would become the goal range. Remember that any amount of legumes is going to make a helpful addition to your diet. And whatever weekly level of legumes you decide to target, we definitely recommend inclusion of black beans among your legume choices.

You will find many of our recipes containing beans gives you the choice between using home cooked beans and canned beans. If you are in a hurry canned beans can be a healthy option. Unlike canned vegetables, which have lost much of their nutritional value, there is little difference in the nutritional value between canned garbanzo beans and those you cook yourself. Like most packaging processes, canning can take place in a variety of ways, and some aspects of canning have raised research concerns with respect to canning materials and their potential health risk. One special concern in the canning area has been the use of bisphenol A (BPA) in resin-based can liners. For more information on this topic, please click here to see the discussion in our Ask George section entitled, You recommend canned organic beans in many of your recipes. Yet, isn't there a concern that these cans may contain Bisphenol A (BPA)?

Black Beans, cooked
1.00 cup
(172.00 grams)

Calories: 227
GI: low

Nutrient	DRI/DV
molybdenum	287%
folate	64%
fiber	60%
copper	40%
manganese	38%
vitamin B1	35%
phosphorus	34%
magnesium	30%
protein	30%
iron	20%

Health Benefits

Among all groups of food commonly eaten worldwide, no group has a more health-supportive mix of protein-plus-fiber than legumes. Included here, of course, is the amazing protein-plus-fiber content of black beans. From a single, one-cup serving of black beans you get nearly 15 grams of fiber (well over half of the Daily Value and the same amount consumed by the average U.S. adult in one entire day of eating) and 15 grams of protein (nearly one third of the Daily Value and equivalent to the amount in 2 ounces of a meat like chicken or a fish like salmon). You won't find this outstanding protein-fiber combination in fruit, vegetables, grains, meats, dairy products, nuts and seeds, or seafood. The almost magical protein-fiber combination in legumes—including black beans—explains important aspects of their health benefits for the digestive tract, the blood sugar regulatory system, and the cardiovascular system. Each area of systems benefit has a strong research basis.

Digestive Tract Benefits

Unlike dietary sugar, which can move very quickly through the digestive tract and out of the digestive tract into the bloodstream, or dietary fat, which can move very slowly through the digestive tract and out of the digestive tract into the lymphatic system or bloodstream, both protein and fiber can move through the digestive tract at a moderate pace. In terms of digestion, both protein and fiber help to "steady" digestive processes. Movement of food from the stomach to the small intestine (called "gastric emptying") and movement of food through the small intestine and the large intestine can occur at a more desirable pace when foods are rich in protein and fiber. This steadying of the digestive process helps lessen the burden on any one part of the digestive tract. This allows food to move along in a way that supports optimal chemical balances and populations of micro-organisms.

The idea of digestive tract support from black beans may sound surprising. Many people think about black beans (and beans in general) as problem-causing foods in the digestive tract, perhaps largely because of gas production. But recent research has shown that black beans actually provide special support in the lower large intestine (colon) where gas if often produced. The indigestible fraction (IF) in black beans has recently been shown to be larger than the IF in either lentils or chickpeas. It is the perfect mix of substances for allowing bacteria in the colon to produce butyric acid. Cells lining the inside of the colon can use this butyric acid to fuel their many activities and keep the lower digestive tract functioning properly. By delivering a greater amount of IF to the colon, black beans are able to help support this lower part of our digestive tract. Lowered colon cancer risk that is associated with black bean intake in some research studies may be related to the outstanding IF content of this legume.

Benefits for Blood Sugar Regulation

The landmark "protein-plus-fiber" combination in black beans and other legumes is also a key to their outstanding support for blood sugar balance and blood sugar regulation. As described earlier, protein and fiber can move through our digestive tract at a moderate pace. Unlike dietary sugar (which can move too quickly), or fat (which can move too slowly), both protein and fiber can move at a moderate pace. By steadying rate of movement through the digestive tract, protein and fiber help to steady the breakdown of food into component parts, including simple sugars. This better-regulated breakdown of food helps to prevent extremes with respect to simple sugar uptake from the digestive tract. Too much simple sugar uptake all at once can result in an unwanted blood sugar spike. Too little simple sugar uptake can result in an unwanted blood sugar drop. Either extreme can work to destabilize blood sugar balance. The 15 fiber grams and 15 protein grams in one cup of black beans help prevent both extremes - excessive simple sugar release from the digestive tract, and also insufficient simple sugar release.

With respect to prevention of type 2 diabetes, researchers have become especially interested in some of the alpha-amylase inhibitory effects of black beans. Naturally occurring compounds in this legume slow down the activity of alpha-amylase enzymes. Since these enzymes are important for breaking down starch into sugar, their slowing down can result in less sugar release from food starches. We suspect that the alpha-amylase inhibitors in black beans work together with proteins and fibers to help steady blood sugar levels and make this legume especially valuable for blood sugar regulation. Although we've seen numerous studies showing decreased risk of type 2 diabetes following increased intake of fiber from plant foods (and especially legumes), we have yet to see a large-scale human study showing particular benefits for type 2 diabetes prevention from increased intake of black beans (versus increased intake of plant fibers, including all legume fibers). But we would not be surprised to see a black bean study that showed this legume to be a standout in the area of type 2 diabetes prevention.

Cardiovascular Benefits

Much of the original research on bean intake and decreased risk of cardiovascular disease focused on the outstanding soluble fiber content of beans. One cup of black beans provides over 4 grams of soluble fiber, and this is precisely the type of fiber that researchers have found especially helpful in lower blood cholesterol levels. Decreased risk of coronary heart disease (CHD) and myocardial infarct (MI, or heart attack) have both been associated with increased intake of soluble fiber from food. In particular, they have been associated with increased intake of soluble fiber from legumes. So it is anything but surprising to see black beans included in the list of legumes that provide us with cardiovascular benefits.

More recent research, however, has gone beyond this soluble fiber story and added new aspects of black bean nourishment to its list of cardiovascular benefits. Included here is the impressive variety of phytonutrients (both antioxidant and anti-inflammatory) contained within black beans. While we tend to think about brightly colored fruits and vegetables as our best source of phytonutrients, black beans are actually a standout food in this phytonutrient area. The seed coat of black beans (the outermost layer that we recognize as the bean's surface) is an outstanding source of three anthocyanin flavonoids: delphinidin, petunidin, and malvidin. These three anthocyanins are primarily responsible for the rich black color that we see on the bean surface. Kaempferol and quercetin are additional flavonoids provided by this legume. All of these flavonoids have well-demonstrated antioxidant and anti-inflammatory properties. Also contained in black beans are hydroxycinnamic acids including ferulic, sinapic, and chlorogenic acid, as well as numerous triterpenoids. These phytonutrients also function as antioxidants and, in some cases, as anti-inflammatory compounds as well. Antioxidant and anti-inflammatory protection is especially important for our cardiovascular system. When our blood vessels are exposed to chronic and excessive risk of oxidative stress (damage by overly reactive oxygen-containing molecules) or inflammation, they are at heightened risk for disease development. The prevention of chronic, excessive oxidative stress and inflammation is a key to decreased risk of most cardiovascular diseases. We expect to see increased attention to the phytonutrient content of black beans in future research on cardiovascular support from this special legume.

When addressing the issue of cardiovascular support, it would be wrong to ignore the rich supply of conventional nutrients in black beans. One cup of black beans provides nearly two-thirds of the Daily Value (DV) for folate--arguably one of the most important B vitamins for decreasing risk of cardiovascular disease. Black beans also provide about 120 milligrams of magnesium per cup. That's nearly one-third of the DV for a mineral that is more commonly associated with cardiovascular protection than any other single mineral. Antioxidant minerals like zinc and manganese are also plentiful in black beans. Finally, black beans provide about 180 milligrams of omega-3 fatty acids per cup in the form of alpha-linolenic acid (ALA).

Other Health Benefits

Given the impressive array of antioxidant and anti-inflammatory phytonutrients in black beans, we have not been surprised to see numerous studies connecting black bean intake with reduced risk of certain cancers, especially colon cancer. Chronic excessive oxidative stress and chronic excessive inflammatory are both risk factors for the development of many cancer types. By increasing the body's supply of antioxidant and anti-inflammatory nutrients, black beans may be able to help lower cancer risk. Most of the studies we've seen have been studies on laboratory animals, or laboratory studies on different cancer cell types. (In other words, we have yet to see large-scale human studies showing decreased risk of cancer following increased intake of black beans.) But these preliminary animal and laboratory studies have been relatively consistent in their findings and have shown black beans to inhibit the development of certain cancers and especially colon cancer. Breast cancer and liver cancer are two additional cancer types that have been studied in animals with respect to black bean intake, although the evidence here is not as strong as evidence in the area of colon cancer. As our knowledge of black bean phytonutrients increases, we expect to see increasing interest in this important area of health research.

Description

Black beans could not be more succinctly and descriptively named. They are commonly referred to as turtle beans, probably in reference to their shiny, dark, shell-like appearance. With a rich flavor that has been compared to mushrooms, black beans have a velvety texture while holding their shape well during cooking.

Black beans are actually a variety of the common bean (*Phaseolus vulgaris*) and belong to the popular legume family of plants. Black beans share many characteristics with their fellow bean family members, including red (kidney) beans, white (navy) beans, yellow beans, pinto (mottled) beans, pink beans, and anasazi beans.

History

Black beans and other beans such as pinto beans, navy beans, and kidney beans are all known scientifically as *Phaselous vulgaris*. (This scientific name refers to the genus and species of the plant; navy, kidney, pinto, etc. are different varieties of beans, all found within the species *vulgaris*). The word "common" is used to describe all of these different varieties, since the word *vulgaris*in Latin means "common." The common bean originated in parts of Central and South America. Even though the common bean falls into a different scientific category than the soybean, research in comparative genetics has shown that these two types of beans (*Phaselous vulgaris* and *Glycine max*) share many interesting genetic aspects. Beans were introduced into Europe in the 15th century by Spanish explorers returning from their voyages to the New World and were subsequently spread to Africa and Asia by Spanish and Portuguese traders. For a wide variety of reasons—including ease of growth, long-term storage ability, taste and texture, and nutrient content (especially protein)—beans have become popular in many cultures throughout the world. Black beans are an important staple in the cuisines of Mexico, Brazil, Cuba, Guatemala and the Dominican Republic.

Today, the largest commercial producers of dried common beans are India and Brazil. Nearly 18 million metric tons of dry beans are produced in these two countries alone. In their green, non-dried form, beans are produced in the greatest volume in China, where nearly 6 million metric tons are produced annually. Other important areas for bean production are Central America, other countries in South America, Mexico, Indonesia, and the United States.

How to Select and Store

Both dried and canned black beans are available throughout the year. Dried beans are generally available in prepackaged containers as well as in bulk bins. Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the black beans are covered and that the store has a good product turnover to ensure the beans' maximal freshness. Whether purchasing black beans in bulk or in packaged containers, make sure that there is no evidence of moisture or insect damage and that they are whole and not cracked.

Canned black beans can be found in most markets. Unlike canned vegetables, which have lost much of their nutritional value, there is little difference in the nutritional value of canned black beans and those you cook yourself. Canning lowers vegetables' nutritional value since they are best lightly cooked for a short period of time, while their canning process requires a long cooking time at high temperatures. On the other hand, beans require a long time to cook whether they are canned or you cook them yourself. Therefore, if enjoying canned beans is more convenient for you, by all means go ahead and enjoy them. We would suggest looking for those that do not contain extra salt or additives. (One concern about canned foods is the potential for cans to be lined with a resin-based material that includes bisphenol A (BPA). To learn more about reducing your exposure to this compound, please read our write-up on the subject.

Store dried black beans in an airtight container in a cool, dry and dark place where they will keep up to 12 months. If you purchase black beans at different times, store them separately since they may feature varying stages of dryness and therefore will require different cooking times. Cooked black beans will keep fresh in the refrigerator for about three days if placed in a covered container.

How to Enjoy

A Few Quick Serving Ideas

- Include black beans with your other favorite toppings next time you make a stuffed baked potato.
- Black bean soup or chili is certain to warm you up on cold winter days or anytime of the year you want to enjoy its nurturing essence.
- For a "mucho bueno" twist on traditional burritos, use black beans in place of refried pinto beans.
- Blend cooked black beans with tomatoes, onions and your favorite spices to create a delicious bean soup.
- For a simple yet delicious lunch or dinner entrée, serve a Cuban inspired meal of black beans and rice.
- In a serving bowl, layer black beans, guacamole, chopped tomatoes, diced onions and cilantro to make a delicious layered dip.

WHFoods Recipes that Feature Black Beans

- 10-Minute Huevos Rancheros
- Poached Huevos Rancheros
- 15-Minute Black Bean Salad
- Mexican Cheese Salad
- Zesty Mexican Soup
- Southwestern Salmon & Black Beans
- Black Bean Burrito, Indian Style
- Black Bean Chili
- Quick Black Bean Chili
- Spicy Black Bean Burrito

Safety

Oxalate Content

Black beans have consistently been determined to have high oxalate content. Oxalates are naturally occurring organic acids found in a wide variety of foods, and in the case of certain medical conditions, they must be greatly restricted in a meal plan to prevent over-accumulation inside the body. Our comprehensive article about oxalates will provide you with practical and detailed information about these organic acids, food, and health.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Black Beans, cooked 1.00 cup 172.00 grams				**Calories: 227 GI: low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
molybdenum	129.00 mcg	287	22.7	excellent
folate	256.28 mcg	64	5.1	very good
fiber	14.96 g	60	4.7	very good
copper	0.36 mg	40	3.2	good
manganese	0.76 mg	38	3.0	good
vitamin B1	0.42 mg	35	2.8	good
phosphorus	240.80 mg	34	2.7	good

protein	15.24 g	30	2.4	good
magnesium	120.40 mg	30	2.4	good
iron	3.61 mg	20	1.6	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Dried peas

When fresh peas are not available or when you want to enjoy a starchier, hardier flavored legume, dried peas are the perfect choice; they are available any time of the year.

Although they belong to the same family as beans and lentils, they are usually distinguished as a separate group because of the ways in which they are prepared. The different types of peas are all spherical, a feature that also sets them apart from beans and lentils. Dried peas are produced by harvesting the peapods when they are fully mature and then drying them. Once they are dried and the skins removed, they split naturally.

Dried Peas, split, cooked
1.00 cup
(196.00 grams)

Calories: 231
GI: low

Nutrient	DRI/DV
molybdenum	327%
fiber	65%
manganese	39%
copper	39%
protein	33%
folate	32%
vitamin B1	31%
phosphorus	28%
pantothenic acid	23%
potassium	20%

Health Benefits

Dried peas, a small but nutritionally mighty member of the legume family, are a very good source of cholesterol-lowering fiber. Not only can dried peas help lower cholesterol, they are also of special benefit in managing blood-sugar disorders since their high fiber content prevents blood sugar levels from rising rapidly after a meal.

Fiber is far from all that dried peas have to offer. Dried peas also provide good to excellent amounts of five important minerals, three B-vitamins, and protein—all with virtually no fat. As if this weren't enough, dried peas also feature isoflavones (notably *daidzein*). Isoflavones are phytonutrients that can act like weak estrogens in the body and whose dietary consumption has been linked to a reduced risk of certain health conditions, including breast and prostate cancer.

Dried Peas are Packed with Fiber

Check a chart of the fiber content in foods and you'll see legumes leading the pack. Dried peas, like other legumes, are rich in soluble fiber. Soluble fiber forms a gel-like substance in the digestive tract that binds bile (which contains cholesterol) and carries it out of the body. Research studies have shown that insoluble fiber not only helps to increase stool bulk and prevent constipation, but also helps prevent digestive disorders like irritable bowel syndrome and diverticulosis. According to our rating system, dried peas are a very good source of dietary fiber.

Dried Peas Provide Energy to Burn While Stabilizing Blood Sugar

In addition to its beneficial effects on the digestive system and the heart, soluble fiber helps stabilize blood sugar levels. If you have insulin resistance, hypoglycemia or diabetes, legumes like dried peas can really help you balance blood sugar levels while providing steady, slow-burning energy. Studies of high fiber diets and blood sugar levels have shown the dramatic benefits provided by these high fiber foods. Researchers compared two groups of people with type 2 diabetes who were fed different amounts of high fiber foods. One group ate the standard American Diabetic diet, which contains 24 grams of fiber/day, while the other group ate a diet containing 50 grams of fiber/day. Those who ate the diet higher in fiber had lower levels of both plasma glucose (blood sugar) and insulin (the hormone that helps blood sugar get into cells). The high fiber group also reduced their total cholesterol by nearly 7%, their triglyceride levels by 10.2% and their VLDL (Very Low Density Lipoprotein--the most dangerous form of cholesterol) by 12.5%.

Take Dried Peas to Heart

In a study that examined food intake patterns and risk of death from coronary heart disease, researchers followed more than 16,000 middle-aged men in the U.S., Finland, The Netherlands, Italy, former Yugoslavia, Greece and Japan for 25 years. Typical food patterns were: higher consumption of dairy products in Northern Europe; higher consumption of meat in the U.S.; higher consumption of vegetables, legumes, fish, and wine in Southern Europe; and higher consumption of cereals, soy products, and fish in Japan. When researchers analyzed this data in relation to the risk of death from heart disease, they found that legumes were associated with an 82% reduction in risk!

In addition to their stellar fiber content, dried peas also feature other heart healthy nutrients. They are a good source of potassium, which may decrease the growth and development of blood vessel plaques and is also good for lowering high blood pressure.

Sensitive to Sulfites? Dried Peas May Help

Dried peas are an excellent source of the trace mineral, molybdenum, an integral component of the enzyme *sulfite oxidase*, which is responsible for detoxifying sulfites. Sulfites are a type of preservative commonly added to prepared foods like delicatessen salads and salad bars. Persons who are sensitive to sulfites in these foods may experience rapid heartbeat, headache or disorientation if sulfites are unwittingly consumed. If you have ever reacted to sulfites, it may be because your molybdenum stores are insufficient to detoxify them. A cup of cooked dried peas provides 196.0% of the daily value for molybdenum.

Description

When fresh peas are not available or when you want to enjoy a starchier, hardier flavored legume, dried peas are perfect. They are available either whole or split, the latter being appropriately called "split peas." While we generally associate dried peas with a deep green color, they are also available in a yellow color, which offers a more delicate flavor and is the type generally preferred in northern European countries. Dried peas are produced by harvesting the peapods when they are fully mature and then drying them. Peas are known scientifically as *Pisum sativum*.

History

The modern-day garden pea, from which dried peas are made, is thought to have originated from the field pea that was native to central Asia and Europe. Dried peas have been consumed since prehistoric times with fossilized remains being found at archeological sites in Swiss lake villages. Peas are mentioned in the Bible and were prized by the ancient civilizations of Egypt, Greece and Rome.

For millennia, dried peas were the main way that people consumed this legume. It was not until the 16th century when cultivation techniques created more tender varieties of garden peas that people began to consume peas in their fresh state as opposed to just eating dried peas. It seems that the Chinese, a culture that had consumed this legume as far back as 2,000 BC, were the first ones to consume both the seeds and the pods as a vegetable. Peas were introduced into United States soon after the colonists first settled in this country.

In the 19th century during the early developments of the study of genetics, peas played an important role. The monk and botanist, Gregor Mendel used peas in his plant breeding experiments.

Today the largest commercial producers of dried peas are Russia, France, China and Denmark.

How to Select and Store

Dried peas are generally available in prepackaged containers as well as bulk bins. They are available as whole peas or split peas. Regardless of packaging, check the peas as best as possible to ensure that they are not cracked and that they are free of debris. Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the dried peas are covered and that the store has a good product turnover so as to ensure its maximal freshness.

Dried peas will keep for several months if stored in an airtight container in a cool, dry, dark place. If you need to store them for longer, you can keep them in the refrigerator.

How to Enjoy

A Few Quick Serving Ideas:

- Use split peas to make dahl, the classic Indian dish.
- Split pea soup, whether homemade or from a container, is a delicious way to enjoy this nutritious legume.
- Purée cooked peas with your favorite herbs and spices and serve as a side dish.
- Add whole peas to vegetable soups.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Dried Peas, split, cooked
1.00 cup
196.00 grams

Calories: 231
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
molybdenum	147.00 mcg	327	25.4	excellent
fiber	16.27 g	65	5.1	very good
manganese	0.78 mg	39	3.0	good
copper	0.35 mg	39	3.0	good
protein	16.35 g	33	2.5	good
folate	127.40 mcg	32	2.5	good
vitamin B1	0.37 mg	31	2.4	good
phosphorus	194.04 mg	28	2.2	good
pantothenic acid	1.17 mg	23	1.8	good
potassium	709.52 mg	20	1.6	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Garbanzo beans (chickpeas)

What's New and Beneficial about Garbanzo Beans

- There's now direct evidence about garbanzo beans and appetite! Participants in a recent study reported more satisfaction with their diet when garbanzo beans were included, and they consumed fewer processed food snacks during test weeks in the study when garbanzo beans were consumed. They also consumed less food overall when the diet was supplemented with garbanzo beans.
- Garbanzo beans (like most legumes) have long been valued for their fiber content. Two cups provide the entire Daily Value! But the research news on garbanzos and fiber has recently taken us one step further by suggesting that the fiber benefits of garbanzo beans may go beyond the fiber benefits of other foods. In a recent study, two groups of participants received about 28 grams of fiber per day. But the two groups were very different in terms of their food sources for fiber. One group received dietary fiber primarily from garbanzo beans. The other group obtained dietary fiber from entirely different sources. The garbanzo bean group had better blood fat regulation, including lower levels of LDL-cholesterol, total cholesterol, and triglycerides.
- In some parts of the world (for example, parts of India), garbanzo beans are eaten daily in large amounts and on a year-round basis. But a recent study has shown that we can obtain health benefits from garbanzo beans even when we eat much smaller amounts over a much shorter period of time. In this study, it took only one week of garbanzo bean consumption to improve participants' control of blood sugar and insulin secretion. Equally important, only one-third cup of the beans per day was needed to provide these blood-sugar related health benefits.
- Garbanzos are a food you definitely want to keep on your "digestive support" list—especially if you are focusing on the colon. Between 65-75% of the fiber found in garbanzo beans is insoluble fiber, and this type of fiber remains undigested all the way down to the final segment of your large intestine (colon). Recent studies have shown that garbanzo bean fiber can be metabolized by bacteria in the colon to produce relatively large amounts of short chain fatty acids (SCFAs), including acetic, propionic, and butyric acid. These SCFAs provide fuel to the cells that line your intestinal wall. By supporting the energy needs of our intestinal cells, the SCFAs made from garbanzo fibers can help lower your risk of colon problems, including your risk of colon cancer.
- Most garbanzo beans found in the grocery (especially canned garbanzos) are cream-colored and relatively round. This type of garbanzo bean is called the "kabuli-type." Worldwide, there's a far more common type of garbanzo bean called the "desi-type." This second type of garbanzo bean is about half the size of cream-colored type we're accustomed to seeing in the grocery, and it's more irregular in shape. The color is also different—varying from light tan to black. Researchers have recently determined that many of the antioxidants present in garbanzo beans are especially concentrated in the outer seed coat that gives the beans their distinctive color. Darker-colored "desi-type" garbanzo beans appear to have thicker seed coats and greater concentrations of antioxidants than the larger and more regularly shaped cream-colored garbanzos that are regularly found at salad bars and in canned products. Of course, it is important to remember that antioxidants can be found in both types of garbanzo beans and you'll get great health benefits from both types. But if you have previously shied away from darker-colored or irregularly-shaped garbanzo beans, we want to encourage you to reconsider and to enjoy all types of garbanzo beans, including the darker-colored and irregularly-shaped ones.

WHFoods Recommendation

Many public health organizations—including the American Diabetes Association, the American Heart Association, and the American Cancer Society—recommend legumes as a key food group for preventing disease and optimizing health. The 2005 Dietary Guidelines for Americans developed by the U.S. Department of Health and Human Services (USDHHS) and the U.S. Department of Agriculture (USDA) recommends 3 cups of legumes per week (based on a daily intake of approximately 2,000 calories). Because 1 serving of legumes was defined as 1/2 cup (cooked), the Dietary Guidelines for Americans come very close to this as they recommend of 1/2 cup of cooked legumes on a daily basis. Based on our own research review, we believe that 3 cups of legumes per week is a very reasonable goal for support of good health. However, we also believe that optimal health benefits from legumes may require consumption of legumes in greater amounts. This recommendation for greater amounts is based upon studies in which legumes have been consumed at least 4 days per week and in amounts falling into a 1-2 cup range per day. These studies suggest a higher optimal health benefit level than the 2005 Dietary Guidelines: instead of 3 cups of weekly legumes, 4-8 cups would become the goal range. Remember that any amount of legumes is going to make a helpful addition to your diet. And whatever weekly level of legumes you decide to target, we definitely recommend inclusion of garbanzo beans among your legume choices.

You will find that many of our recipes containing beans gives you the choice between using home cooked beans and canned beans. If you are in a hurry canned beans can be a healthy option. Unlike canned vegetables, which have lost much of their nutritional value, there is little difference in the nutritional value between canned garbanzo beans and those you cook yourself. However there may be some concern over the BPA content of canned products. To find out if the cans of your favorite canned beans are lined with BPA, you will need to contact the manufacturer. Your best bet to avoid BPA is to factor in a little more time to your meal preparation process and prepare beans yourself. See Healthiest Way of Cooking Garbanzo Beans below.

Garbanzo Beans, cooked
1.00 cup
(164.00 grams)

Calories: 269
GI: low

Nutrient	DRI/DV
molybdenum	273%
manganese	85%
folate	71%
copper	64%
fiber	50%
phosphorus	39%
protein	29%
iron	26%
zinc	23%

Health Benefits

Digestive Tract Support

Even though legumes are known for their fiber, most people do not know how helpful the fiber in garbanzo beans can actually be for supporting digestive tract function. First is the issue of amount. Garbanzos contain about 12.5 grams of fiber per cup. That's 50% of the Daily Value (DV)! In addition to this plentiful amount, at least two-thirds of the fiber in garbanzos is insoluble. This insoluble fiber typically passes all the way through our digestive tract unchanged, until it reaches the last part of our large intestine (the colon). Bacteria in our colon can break down the garbanzos' insoluble fiber into short chain fatty acids (SCFAs) including acetic acid, propionic acid, and butyric acid. These SCFAs can be absorbed by the cells that line our colon wall and can be used by these cells for energy. In fact, butyric acid is the preferred source of energy for the cells lining our colon. With the extra amounts of energy provided by SCFAs from the insoluble fiber in garbanzos, our colon cells can stay optimally active and healthy. Healthier colon cell function means lower risk for us of colon problems, including lower risk of colon cancer.

Unique Supply of Antioxidants

Many of our body systems are susceptible to oxidative stress and damage from reactive oxygen molecules. These systems include our cardiovascular system, our lungs, and our nervous system. Plentiful amounts of antioxidant nutrients are critical for the support of these body systems, and garbanzo beans are a remarkable food in terms of their antioxidant composition. While containing small but valuable amounts of conventional antioxidant nutrients like vitamin C, vitamin E, and beta-carotene, garbanzo beans also contain more concentrated supplies of antioxidant phytonutrients. These phytonutrients include the flavonoids quercetin, kaempferol, and myricetin (usually found in the outer layer of the beans), and the phenolic acids ferulic acid, chlorogenic acid, caffeic acid, and vanillic acid (usually found in the interior portion of the beans). Depending on the type of bean and color/thickness of the outer layer, garbanzo beans can also contain significant amounts of the anthocyanins delphinidin, cyanidin, and petunidin. The mineral manganese—a key antioxidant in the energy-producing mitochondria found inside most cells—is also provided in excellent amounts by garbanzo beans. In fact, just one cup of garbanzos can provide you with nearly 85% of the Daily Value (DV) for this key antioxidant. An increasing number of animal and human studies clearly show the ability of garbanzo beans to reduce our risk of heart disease, and we believe that an important part of this risk reduction is due to the fantastic antioxidant make-up of these legumes.

Decreased Cardiovascular Risks

While epidemiologic studies don't always single out garbanzo beans from other beans when determining their relationship to cardiovascular disease, garbanzo beans are almost always included in the list of legumes studied when heart disease is the focus of diet research. Large-scale epidemiologic studies give us a great look at potential heart benefits from garbanzo beans, and the evidence shows garbanzo beans to be outstanding in this area. As little as 3/4 cup of garbanzos per day can help lower our LDL-cholesterol, total cholesterol, and triglycerides in a one-month period of time. This cardiovascular support is likely to come from multiple aspects of garbanzo beans and their nutrient composition. About one-third of the fiber in garbanzo beans is soluble fiber, and this type of fiber is the type most closely associated with support of heart health. As mentioned earlier in this Health Benefits section, garbanzo beans also have a unique combination of antioxidants, and these antioxidants clearly provide support for our blood vessels walls and blood itself. And while garbanzo beans are not a fatty food, they do contain valuable amounts of polyunsaturated fatty acids, including alpha-linolenic acid (ALA), the body's omega-3 fatty acid from which all other omega-3 fats are made. There are about 70-80 milligrams of ALA in every cup of garbanzo beans, and there are about 2 grams of other polyunsaturated fatty acids. Risk of coronary heart disease is one of the specific types of cardiovascular risks that has been shown to be reduced by regular intake of garbanzo beans and other legumes.

Better Regulation of Blood Sugar

No food macronutrients are more valuable for blood sugar regulation than fiber and protein. These two nutrients have an amazing ability to help stabilize the flow of food through our digestive tract and prevent the breakdown of food from taking place too quickly or too slowly. When food passes through us at a healthy rate of speed, release of sugar from the food is typically better regulated. Strong vitamin and mineral composition of a food - including strong antioxidant composition - can also help stabilize its digestive impact on our blood sugar. Given these basic relationships between nutrition and blood sugar control, it's not surprising to see garbanzo beans improving blood sugar regulation in research studies. We've seen studies in which participants consumed as little as 1/2 cup of garbanzo beans per day and still witnessed better blood sugar control in as little as one week. In animal studies, garbanzo-based improvements in blood sugar regulation have partly been linked to better control of insulin output and overall insulin function. We suspect that some of these blood sugar benefits are directly related to improved digestive function. Garbanzo beans are a fantastic food for providing our digestive system with nutrient support. Even though research studies have shown blood sugar benefits with as little as 1/2 cup servings of garbanzo beans, we recommend that you consider more generous single servings of this delicious legume, in the range of up to 1 cup.

Increased Chances for Satiety and Decreased Caloric Intake

We have been excited to see recent studies showing a positive relationship between garbanzo beans and weight management. The best single study we've seen in this regard has been a study that measured food satiety. "Food satiety" is the scientific term used to describe our satisfaction with food—how full it leaves us feeling, and how effective it is in eliminating our sense of hunger and appetite. Participants in a recent study were found to consume fewer snacks and fewer overall calories when supplementing their regular diet with garbanzo beans. They were also found to report greater food satiety, with experiences of reduced appetite and greater food satisfaction. We look forward to some large-scale studies in this area, and we expect to see a clear role being carved out for garbanzo beans in terms of weight loss and weight management. Along with their unusual combination of protein and fiber and their great ability to stabilize digestion, garbanzo beans also stand out as a food that is moderate in terms of calories. At approximately 270 calories per cup, we're talking about 10-15% of daily calories. In return for this moderate calorie cost, we get 50% of the DV for fiber and 29% of the DV for protein. Those nutrient amounts are great trade-offs for anyone struggling with weight loss or weight management.

Description

Garbanzo beans (also known as chickpeas, Bengal grams, and Egyptian peas) have a delicious nutlike taste and buttery texture. They provide a concentrated source of protein that can be enjoyed year-round and are available either dried or canned. The Latin name for garbanzo beans, *Cicer arietinum*, means "small ram," reflecting the unique shape of this legume that somewhat resembles a ram's head.

Garbanzos have a delicious nutlike taste and a texture that is buttery, yet somewhat starchy and pasty. A very versatile legume, they are a noted ingredient in many Middle Eastern and Indian dishes such as hummus, falafels and curries.

There are two basic types of garbanzo beans. Most commonly seen at salad bars and in canned products are the "kabuli-type." These beans are cream-colored or sometimes whitish in color, fairly uniform and rounded in shape, and about twice as large as the second "desi-type." In addition to being much smaller, desi-type beans are darker (light tan to black in color) and more irregular in shape. From a botanical standpoint, the desi-type beans also have a thicker seed coat (the seed coat is the protective outermost layer of the bean). While kabuli-type beans are the ones we are accustomed to finding in U.S. salad bars and grocery stores, they actually represent only 10-20% of the garbanzo beans consumed worldwide, where the vast majority of garbanzos are desi-type beans. There are great health benefits from both types of garbanzos. However, in the case of some nutrients—including some antioxidant nutrients like quercetin, kaempferol and myricetin—desi-type beans provide more concentrated nutrient amounts since these nutrients are found in the seed coat and this seed coat is thicker in desi-type beans.

History

Garbanzo beans originated in the Middle East, the region of the world whose varied food cultures still heavily rely upon this high protein legume. The first record of garbanzo beans being consumed dates back about seven thousand years. They were first cultivated around approximately 3000 BC. Their cultivation began in the Mediterranean basin and subsequently spread to India and Ethiopia.

Garbanzo beans were grown by the ancient Egyptians, Greeks and Romans and were very popular among these cultures. During the 16th century, garbanzo beans were brought to other subtropical regions of the world by both Spanish and Portuguese explorers as well as Indians who emigrated to other countries. Today, the main commercial producers of garbanzos are India, Pakistan, Turkey, Ethiopia and Mexico.

How to Select and Store

Dried garbanzos are generally available in prepackaged containers as well as bulk bins. Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the garbanzo beans are covered and that the store has a good product turnover so as to ensure maximum freshness. Whether purchasing garbanzo beans in bulk or in a packaged container, make sure that there is no evidence of moisture or insect damage and that they are whole and not cracked.

Canned garbanzo beans can be found in most supermarkets. Unlike canned vegetables, which have lost much of their nutritional value, canning does less damage to many of the key nutrients found in garbanzo beans. For example, many people rely on garbanzo beans (and other legumes) for protein and fiber in their daily diet, and canning only lowers the amount of these nutrients by about 15%. Many of the B vitamins hold up well in canned garbanzo beans, and some actually show up in higher concentrations in canned versus non-canned versions. An important exception here is folate, which is decreased by about 40-45% during canning. (If you are depending on your garbanzo beans for this important B vitamin, you will want to consider purchasing dry garbanzo beans and cooking them yourself.) Canning will generally lower the nutrient content of food since long cooking time and/or high heats are often involved. The nutritional impact of canning on vegetables can be extremely high since vegetables are best cooked very lightly for a very short period of time. Legumes like garbanzo beans are different than vegetables, however, since they require a long time to cook whether they are canned or cooked by you at home from the dry version. While canned garbanzo beans may be more convenient, there is a concern about the BPA that is used in the lining of many canned foods. Some manufacturers do not use BPA-lined cans and it is worth seeking these out. To find out if the cans of your favorite canned beans are lined with BPA, you will need to contact the manufacturer. (For more on BPA, see this article.) Also when it comes to canned garbanzo beans, we would suggest looking for those that do not contain extra salt or additives. Once you remove the beans from the can, place them in a strainer and rinse them thoroughly for one minute.

If purchasing chickpea (garbanzo bean) flour, more generally available in ethnic food stores, make sure that it is made from beans that have been cooked since in their raw form, they contain a substance that is hard to digest and can produce flatulence.

Store dried garbanzo beans in an airtight container in a cool, dry and dark place where they will keep for up to 12 months. If you purchase garbanzo beans at different times, store them separately since they may feature varying stages of dryness and therefore will require different cooking times. Cooked garbanzo beans will keep fresh in the refrigerator for about three days if placed in a covered container.

How to Enjoy

A Few Quick Serving Ideas

- Puree garbanzo beans, olive oil, fresh garlic, tahini and lemon juice to make a quick and easy hummus spread.
- Sprinkle garbanzo beans with your favorite spices and herbs and eat as a snack.
- Add garbanzo beans to your green salads.
- Make a Middle Eastern-inspired pasta dish by adding garbanzo beans to penne mixed with olive oil, feta cheese and fresh oregano.
- Simmer cooked garbanzo beans in a sauce of tomato paste, curry spices, and chopped walnuts and serve this dahl-type dish with brown rice.
- Adding garbanzo beans to your vegetable soup will enhance its taste, texture and nutritional content.

WHFoods Recipes That Feature Garbanzo Beans

- 15-Minute Greek Garbanzo Bean Salad
- 5-Minute Greek Garbanzo Bean Salad
- 5-Minute Garbanzo Beans with Turmeric
- Greek Salad
- Healthy Veggie Salad
- Mediterranean Baby Spinach Salad
- Mediterranean-Style Salad
- Curried Mustard Greens & Garbanzo Beans with Sweet Potatoes
- Moroccan Eggplant with Garbanzo Beans
- Fresh Minted Garbanzo Salad
- Garlic Dip with Crudites

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Garbanzo Beans, cooked
1.00 cup
164.00 grams

Calories: 269
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
molybdenum	123.00 mcg	273	18.3	excellent
manganese	1.69 mg	85	5.7	excellent
folate	282.08 mcg	71	4.7	very good
copper	0.58 mg	64	4.3	very good
fiber	12.46 g	50	3.3	good
phosphorus	275.52 mg	39	2.6	good
protein	14.53 g	29	1.9	good
iron	4.74 mg	26	1.8	good
zinc	2.51 mg	23	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Kidney beans

Both dried and canned kidney beans are available throughout the year. Dried beans are generally available in prepackaged containers as well as in bulk bins.

True to their name, these popular beans are kidney shaped and are especially good in simmered dishes where they absorb the flavors of seasonings and the other foods with which they are cooked.

Kidney Beans, cooked
1.00 cup
(177.00 grams)

Calories: 225
GI: low

Nutrient	DRI/DV
molybdenum	295%
folate	58%
fiber	45%
copper	42%
manganese	38%
phosphorus	35%
protein	31%
vitamin B1	23%
iron	22%
potassium	20%
magnesium	19%

Health Benefits

Kidney beans are a very good source of cholesterol-lowering fiber, as are most other beans. In addition to lowering cholesterol, kidney beans' high fiber content prevents blood sugar levels from rising too rapidly after a meal, making these beans an especially good choice for individuals with diabetes, insulin resistance or hypoglycemia. When combined with whole grains such as rice, kidney beans provide virtually fat-free high quality protein. But this is far from all kidney beans have to offer. Kidney beans are an excellent source of the trace mineral, molybdenum, an integral component of the enzyme sulfite oxidase, which is responsible for detoxifying sulfites. Sulfites are a type of preservative commonly added to prepared foods like delicatessen salads and salad bars. Persons who are sensitive to sulfites in these foods may experience rapid heartbeat, headache or disorientation if sulfites are unwittingly consumed. If you have ever reacted to sulfites, it may be because your molybdenum stores are insufficient to detoxify them.

A Fiber All Star

Check a chart of the fiber content in foods and you'll see legumes leading the pack. Kidney beans, like other beans, are rich in soluble and insoluble fiber. Soluble fiber forms a gel-like substance in the digestive tract that binds with bile (which contains cholesterol)and ferries it out of the body. Research studies have shown that insoluble fiber not only helps to increase stool bulk and prevent constipation, but also helps prevent digestive disorders like irritable bowel syndrome and diverticulosis.

Lower Your Heart Attack Risk

In a study that examined food intake patterns and risk of death from coronary heart disease, researchers followed more than 16,000 middle-aged men in the U.S., Finland, The Netherlands, Italy, former Yugoslavia, Greece and Japan for 25 years. Typical food patterns were: higher consumption of dairy products in Northern Europe; higher consumption of meat in the U.S.; higher consumption of vegetables, legumes, fish, and wine in Southern Europe; and higher consumption of cereals, soy products, and fish in Japan. When researchers analyzed this data in relation to the risk of death from heart disease, they found that higher legume consumption was associated with a whopping 82% reduction in risk!

A study published in the *Archives of Internal Medicine* confirms that eating high fiber foods, such as kidney beans, helps prevent heart disease. Almost 10,000 American adults participated in this study and were followed for 19 years. People eating the most fiber, 21 grams per day, had 12% less coronary heart disease (CHD) and 11% less cardiovascular disease (CVD) compared to those eating the least, 5 grams daily. Those eating the most water-soluble dietary fiber fared even better with a 15% reduction in risk of CHD and a 10% risk reduction in CVD.

Kidney beans' contribution to heart health lies not just in their fiber, but in the significant amounts of folate and magnesium these beans supply. Folate helps lower levels of homocysteine, an amino acid that is an intermediate product in an important metabolic process called the methylation cycle. Elevated blood levels of homocysteine are an independent risk factor for heart attack, stroke, or peripheral vascular disease, and are found in between 20-40% of patients with heart disease. It has been estimated that consumption of 100% of the daily value (DV) of folate would, by itself, reduce the number of heart attacks suffered by Americans each year by 10%. Kidney beans are a very good source of folate.

Kidney beans' good supply of magnesium puts yet another plus in the column of its beneficial cardiovascular effects. Magnesium is Nature's own calcium channel blocker. When there is enough magnesium around, veins and arteries breathe a sigh of relief and relax, which lessens resistance and improves the flow of blood, oxygen and nutrients throughout the body. Studies show that a deficiency of magnesium is not only associated with heart attack but that immediately following a heart attack, lack of sufficient magnesium promotes free radical injury to the heart. Want to literally keep your heart happy?

Kidney Beans Give You Energy to Burn While Stabilizing Blood Sugar

In addition to its beneficial effects on the digestive system and the heart, soluble fiber helps stabilize blood sugar levels. If you have insulin resistance, hypoglycemia or diabetes, kidney beans can really help you balance blood sugar levels while providing steady, slow-burning energy. Studies of high fiber diets and blood sugar levels have shown the dramatic benefits provided by these high fiber foods. Researchers compared two groups of people with type 2 diabetes who were fed different amounts of high fiber foods. One group ate the standard American Diabetic diet, which contained 24 grams of fiber/day, while the other group ate a diet containing 50 grams of fiber/day. Those who ate the diet higher in fiber had lower levels of both plasma glucose (blood sugar) and insulin (the hormone that helps blood sugar get into cells). The high fiber group also reduced their total cholesterol by nearly 7%, their triglyceride levels by 10.2% and their VLDL (Very Low Density Lipoprotein—the most dangerous form of cholesterol) levels by 12.5%.

Iron for Energy

In addition to providing slow burning complex carbohydrates, kidney beans can increase your energy by helping to replenish your iron stores. Particularly for menstruating women, who are more at risk for iron deficiency, boosting iron stores with kidney beans is a good idea—especially because, unlike red meat, another source of iron, kidney beans are low in calories and virtually fat-free. Iron is an integral component of hemoglobin, which transports oxygen from the lungs to all body cells, and is also part of key enzyme systems for energy production and metabolism. And remember: If you're pregnant or lactating, your needs for iron increase. Growing children and adolescents also have increased needs for iron.

Maintain Your Memory with Thiamin (Vitamin B1)

Thiamin participates in enzymatic reactions central to energy production and is also critical for brain cell/cognitive function. This is because thiamin is needed for the synthesis of *acetylcholine*, the important neurotransmitter essential for memory and whose lack has been found to be a significant contributing factor in age-related impairment in mental function (senility) and Alzheimer's disease. Alzheimer's disease is clinically characterized by a decrease in acetylcholine levels.

Manganese for Energy Production and Antioxidant Defense

Kidney beans are a good source of the trace mineral manganese which is an essential cofactor in a number of enzymes important in energy production and antioxidant defenses. For example, the key oxidative enzyme superoxide dismutase, which disarms free radicals produced within the mitochondria (the energy production factories within our cells), requires manganese.

Protein Power Plus

If you're wondering how to replace red meat in your menus, become a fan of kidney beans. These hearty beans are a good source of protein, and when combined with a whole grain such as whole wheat pasta or brown rice provide protein comparable to that of meat or dairy foods without the high calories or saturated fat found in these foods. And, when you get your protein from kidney beans, you also get the blood sugar stabilizing and heart health benefits of the soluble fiber provided by these versatile legumes. A cup of kidney beans provides over 15 grams of protein.

Description

Just as its name suggests, the kidney bean is shaped like a kidney. Since these dark red beans hold their shape really well during cooking and readily absorb surrounding flavors, they are a favorite bean to use in simmered dishes. Kidney beans that are white in color are known as cannellini beans.

History

Kidney beans and other beans such as pinto beans, navy beans and black beans are known scientifically as *Phaseolus vulgaris*. They are referred to as "common beans" probably owing to the fact that they all derived from a common bean ancestor that originated in Peru.

They spread throughout South and Central America as a result of migrating Indian traders who brought kidney beans with them from Peru. Beans were introduced into Europe in the 15th century by Spanish explorers returning from their voyages to the New World.

Subsequently, Spanish and Portuguese traders introduced kidney beans into Africa and Asia. As beans are a very inexpensive form of good protein, they have become popular in many cultures throughout the world. Today, the largest commercial producers of dried common beans are India, China, Indonesia, Brazil and the United States.

How to Select and Store

Dried kidney beans are generally available in prepackaged containers as well as bulk bins. Just as with any other food that you purchase in the bulk section, make sure the bins are covered and that the store has a good product turnover rate.

Whether purchasing kidney beans in bulk or in a packaged container, make sure there is no evidence of moisture or insect damage and that the beans are whole and not cracked.

Canned kidney beans can be found in most markets. Unlike canned vegetables, which have lost much of their nutritional value, there is little difference in the nutritional value of canned kidney beans and those you cook yourself. Canning lowers vegetables' nutritional value since they are best lightly cooked for a short period of time, while their canning process requires a long cooking time at high temperatures. On the other hand, beans require a long time to cook whether they are canned or you cook them yourself. Therefore, if enjoying canned beans is more convenient for you, by all means go ahead and enjoy them. We would suggest looking for those that do not contain extra salt or additives. (One concern about canned foods is the potential for the can to include a liner made from bisphenol A/BPA. To learn more about reducing your exposure to this compound, please read our write-up on the subject).

Store dried kidney beans in an airtight container in a cool, dry and dark place where they will keep for up to 12 months.

Cooked kidney beans will keep fresh in the refrigerator for about three days if placed in a covered container.

How to Enjoy

A Few Quick Serving Ideas

- Combine cooked kidney beans with black beans and white beans to make a colorful three bean salad.
- Mix with tomatos and scallions and dress with olive oil, lemon juice, salt and black pepper.
- Serve cooked kidney beans over a piece of cornbread and top with grated cheese for a twist on the traditional tamale pie.
- In a food processor or blender, combine cooked kidney beans with garlic, cumin and chili peppers for a delicious spread that can be used as a crudité dip or sandwich filling.
- Make a pot of chili, the hearty Mexican soup that traditionally features kidney beans.
- Make tacos with a vegetarian twist by using kidney beans in place of ground meat.

Safety

Oxalate Content

Kidney beans have consistently been determined to have high oxalate content. Oxalates are naturally occurring organic acids found in a wide variety of foods, and in the case of certain medical conditions, they must be greatly restricted in a meal plan to prevent over-accumulation inside the body. Our comprehensive article about oxalates will provide you with practical and detailed information about these organic acids, food, and health.

Kidney Beans and Phytohemagglutinin

In raw form, kidney beans can contain excessively high amounts of a potentially toxic substance called phytohemagglutinin. This substance is classified as a lectin glycoprotein, and in sufficiently high amounts it has been shown to disrupt cellular metabolism. The amount of this toxin in beans is usually measured in terms of hemagglutinating units, or hau. In their raw form, red kidney beans can contain 20,000 to 70,000 hau. This number drops down to 200 to 400 hau with fully cooked red beans. White kidney beans start off with about 1/3rd less hemagglutinin than ones.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Kidney Beans, cooked **1.00 cup** **177.00 grams**				**Calories: 225** **GI: low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
molybdenum	132.75 mcg	295	23.6	excellent
folate	230.10 mcg	58	4.6	very good
fiber	11.33 g	45	3.6	very good
copper	0.38 mg	42	3.4	very good
manganese	0.76 mg	38	3.0	good
phosphorus	244.26 mg	35	2.8	good
protein	15.35 g	31	2.5	good
vitamin B1	0.28 mg	23	1.9	good
iron	3.93 mg	22	1.7	good
potassium	716.85 mg	20	1.6	good
magnesium	74.34 mg	19	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Lentils

Compared to other types of dried beans, lentils are relatively quick and easy to prepare. They readily absorb a variety of wonderful flavors from other foods and seasonings, are high in nutritional value and are available throughout the year.

Lentils are legumes along with other types of beans. They grow in pods that contain either one or two lentil seeds that are round, oval or heart-shaped disks and are oftentimes smaller than the tip of a pencil eraser. They may be sold whole or split into halves with the brown and green varieties being the best at retaining their shape after cooking.

Lentils, cooked
1.00 cup
(198.00 grams)

Calories: 230
GI: low

Nutrient	DRI/DV
molybdenum	330%
folate	90%
fiber	63%
copper	56%
phosphorus	51%
manganese	49%
iron	37%
protein	36%
vitamin B1	28%
pantothenic acid	25%
zinc	23%
vitamin B6	21%
potassium	21%

Health Benefits

Lentils, a small but nutritionally mighty member of the legume family, are a very good source of cholesterol-lowering fiber. Not only do lentils help lower cholesterol, they are of special benefit in managing blood-sugar disorders since their high fiber content prevents blood sugar levels from rising rapidly after a meal. But this is far from all lentils have to offer. Lentils also provide good to excellent amounts of seven important minerals, our B-vitamins, and protein—all with virtually no fat. The calorie cost of all this nutrition? Just 230 calories for a whole cup of cooked lentils. This tiny nutritional giant fills you up—not out.

Lentils—A Fiber All Star

Check a chart of the fiber content in foods; you'll see legumes leading the pack. Lentils, like other beans, are rich in dietary fiber, both the soluble and insoluble type. Soluble fiber forms a gel-like substance in the digestive tract that snares bile (which contains cholesterol)and ferries it out of the body. Research studies have shown that insoluble fiber not only helps to increase stool bulk and prevent constipation, but also helps prevent digestive disorders like irritable bowel syndrome and diverticulosis.

Love Your Heart—Eat Lentils

In a study that examined food intake patterns and risk of death from coronary heart disease, researchers followed more than 16,000 middle-aged men in the U.S., Finland, The Netherlands, Italy, former Yugoslavia, Greece and Japan for 25 years. Typical food patterns were: higher consumption of dairy products in Northern Europe; higher consumption of meat in the U.S.; higher consumption of vegetables, legumes, fish, and wine in Southern Europe; and higher consumption of cereals, soy products, and fish in Japan. When researchers analyzed this data in relation to the risk of death from heart disease, they found that legumes were associated with a whopping 82% reduction in risk!!

A study published in the *Archives of Internal Medicine* confirms that eating high fiber foods, such as lentils, helps prevent heart disease. Almost 10,000 American adults participated in this study and were followed for 19 years. People eating the most fiber, 21 grams per day, had 12% less coronary heart disease (CHD) and 11% less cardiovascular disease (CVD) compared to those eating the least, 5 grams daily. Those eating the most water-soluble dietary fiber fared even better with a 15% reduction in risk of CHD and a 10% risk reduction in CVD.

Lentils' contribution to heart health lies not just in their fiber, but in the significant amounts of folate and magnesium these little wonders supply. Folate helps lower levels of homocysteine, an amino acid that is an intermediate product in an important metabolic process called the methylation cycle. When folate (as well as vitamin B6) are around, homocysteine is immediately converted into cysteine or methionine, both of which are benign. When these B vitamins are not available, levels of homocysteine increase in the bloodstream—a bad idea since homocysteine damages artery walls and is considered a serious risk factor for heart disease.

Lentils' magnesium puts yet another plus in the column of its beneficial cardiovascular effects. Magnesium is Nature's own calcium channel blocker. When enough magnesium is around, veins and arteries breathe a sigh of relief and relax, which lessens resistance and improves the flow of blood, oxygen and nutrients throughout the body. Studies show that a deficiency of magnesium is not only associated with heart attack but that immediately following a heart attack, lack of sufficient magnesium promotes free radical injury to the heart. Want to literally keep your heart happy? Eat lentils.

Lentils Give You Energy to Burn While Stabilizing Blood Sugar

In addition to its beneficial effects on the digestive system and the heart, soluble fiber helps stabilize blood sugar levels. If you have insulin resistance, hypoglycemia or diabetes, legumes like lentils can really help you balance blood sugar levels while providing steady, slow-burning energy. Studies of high fiber diets and blood sugar levels have shown the dramatic benefits provided by these high fiber foods. Researchers compared two groups of people with type 2 diabetes who were fed different amounts of high fiber foods. One group ate the standard American Diabetic diet, which contains with 24 grams of fiber/day, while the other group ate a diet containing 50 grams of fiber/day. Those who ate the diet higher in fiber had lower levels of both plasma glucose (blood sugar) and insulin (the hormone that helps blood sugar get into cells). The high fiber group also reduced their total cholesterol by nearly 7%, their triglyceride levels by 10.2% and their VLDL (Very Low Density Lipoprotein—the most dangerous form of cholesterol)levels by 12.5%.

Iron for Energy

In addition to providing slow burning complex carbohydrates, lentils can increase your energy by replenishing your iron stores. Particularly for menstruating women, who are more at risk for iron deficiency, boosting iron stores with lentils is a good idea—especially because, unlike red meat, another source of iron, lentils are not rich in fat and calories. Iron is an integral component of hemoglobin, which transports oxygen from the lungs to all body cells, and is also part of key enzyme systems for energy production and metabolism. And remember: If you're pregnant or lactating, your needs for iron increase. Growing children and adolescents also have increased needs for iron.

Description

Lentils are legumes, seeds of a plant whose botanical name is *Lens ensculenta*. They grow in pods that contain either one or two lentil seeds.

Lentils are classified according to whether they are large or small in size with dozens of varieties of each being cultivated. While the most common types in the United States are either green or brown, lentils are also available in black, yellow, red and orange colors. These round, oval or heart-shaped disks are small in size, oftentimes smaller than the tip of a pencil eraser. They are sold whole or split into halves.

The different types offer varying consistencies with the brown and green ones better retaining their shape after cooking, while the others generally become soft and mushy. While the flavor differs slightly among the varieties, they generally feature a hearty dense somewhat nutty flavor.

History

Lentils are believed to have originated in central Asia, having been consumed since prehistoric times. They are one of the first foods to have ever been cultivated. Lentil seeds dating back 8000 years have been found at archeological sites in the Middle East. Lentils were mentioned in the Bible both as the item that Jacob traded to Esau for his birthright and as a part of a bread that was made during the Babylonian captivity of the Jewish people.

For millennia, lentils have been traditionally been eaten with barley and wheat, three foodstuffs that originated in the same regions and spread throughout Africa and Europe during similar migrations and explorations of cultural tribes. Before the 1st century AD, they were introduced into India, a country whose traditional cuisine still bestows high regard for the spiced lentil dish known as dal. In many Catholic countries, lentils have long been used as a staple food during Lent. Currently, the leading commercial producers of lentils include India, Turkey, Canada, China and Syria.

How to Select and Store

Lentils are generally available in prepackaged containers as well as bulk bins. Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the lentils are covered and that the store has a good product turnover so as to ensure its maximal freshness. Whether purchasing lentils in bulk or in a packaged container, make sure there is no evidence of moisture or insect damage and that the lentils are whole and not cracked.

Canned lentils can be found in some grocery stores and most natural foods markets. Unlike canned vegetables, which have lost much of their nutritional value, there is little difference in the nutritional value of canned lentils and those you cook yourself. Canning lowers vegetables' nutritional value since they are best lightly cooked for a short period of time, while their canning process requires a long cooking time at high temperatures. On the other hand, beans require a long time to cook whether they are canned or you cook them yourself. Therefore, if enjoying lentils is more convenient for you, by all means go ahead and enjoy them. We would suggest looking for those that do not contain extra salt or additives. (One concern about canned foods is the potential for the can to include a liner made from bisphenol A/BPA. To learn more about reducing your exposure to this compound, please read our write-up on the subject).

Store lentils in an airtight container in a cool, dry and dark place. Stored this way, they will keep for up to 12 months. If you purchase lentils at different times, store them separately since they may feature varying stages of dryness and therefore will require different cooking times. Cooked lentils will keep fresh in the refrigerator for about three days if placed in a covered container.

How to Enjoy

A Few Quick Serving Ideas

- Combine cooked lentils, and chopped sweet peppers to make a delicious cold salad. Season with your favorite herbs and spices.
- Toss buckwheat soba noodles with cooked lentils, small broccoli florets and leeks. Dress with olive oil mixed with garlic and ginger.
- Moroccan lentil soup is easy to make. After cooking lentils, add diced vegetables of your choice and season with soy sauce, coriander, cumin, turmeric and cayenne.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Lentils, cooked **1.00 cup** **198.00 grams**			**Calories: 230** **GI: low**
	DRI/DV	**Nutrient**	**World's Healthiest**

Nutrient	Amount	(%)	Density	Foods Rating
molybdenum	148.50 mcg	330	25.9	excellent
folate	358.38 mcg	90	7.0	excellent
fiber	15.64 g	63	4.9	very good
copper	0.50 mg	56	4.4	very good
phosphorus	356.40 mg	51	4.0	very good
manganese	0.98 mg	49	3.8	very good
iron	6.59 mg	37	2.9	good
protein	17.86 g	36	2.8	good
vitamin B1	0.33 mg	28	2.2	good
pantothenic acid	1.26 mg	25	2.0	good
zinc	2.51 mg	23	1.8	good
potassium	730.62 mg	21	1.6	good
vitamin B6	0.35 mg	21	1.6	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Lima beans

Sometimes called "butter beans" because of their starchy yet buttery texture, lima beans have a delicate flavor that complements a wide variety of dishes. Although fresh lima beans are often difficult to find, they are worth looking for in the summer and fall when they are in season. Dried and canned lima beans are available throughout the year.

The pod of the lima bean is flat, oblong and slightly curved, averaging about three inches in length. Within the pod are the two to four flat kidney-shaped seeds that we call lima beans. The seeds are generally cream or green in color, although certain varieties feature colors such as white, red, purple, brown or black.

Lima Beans, cooked
1.00 cup
(188.00 grams)

Calories: 216
GI: low

Nutrient	DRI/DV
molybdenum	313%
fiber	53%
copper	49%
manganese	49%
folate	39%
phosphorus	30%
protein	29%
potassium	27%
vitamin B1	25%
iron	25%
magnesium	20%
vitamin B6	18%

Health Benefits

Lima beans are a very good source of cholesterol-lowering fiber, as are most other legumes. In addition to lowering cholesterol, lima beans' high fiber content prevents blood sugar levels from rising too rapidly after a meal, making these beans an especially good choice for individuals with diabetes, insulin resistance or hypoglycemia. When combined with whole grains such as rice, lima beans provide virtually fat-free high quality protein. You may already be familiar with beans' fiber and protein, but this is far from all lima beans have to offer.

Sensitive to Sulfites? Lima Beans May Help

Lima beans are an excellent source of the trace mineral, molybdenum, an integral component of the enzyme *sulfite oxidase*, which is responsible for detoxifying sulfites. Sulfites are a type of preservative commonly added to prepared foods like delicatessen salads and salad bars. Persons who are sensitive to sulfites in these foods may experience rapid heartbeat, headache or disorientation if sulfites are unwittingly consumed. If you have ever reacted to sulfites, it may be because your molybdenum stores are insufficient to detoxify them.

A Fiber All Star

Check a chart of the fiber content in foods and you'll see legumes leading the pack. Lima beans, like other beans, are rich in dietary fiber. For this reason, lima beans and other beans are useful foods for people with irregular glucose metabolism, such as diabetics and those with hypoglycemia, because beans have a low glycemic index rating. This means that blood glucose (blood sugar) does not rise as high after eating beans as it does when compared to many other foods. This beneficial effect is probably due to two factors: the presence of higher amounts of absorption-slowing protein in the beans, and their high soluble fiber content. Soluble fiber absorbs water in the stomach forming a gel that slows down the metabolism of the bean's carbohydrates. The presence of fiber is also the primary factor in the cholesterol-lowering power of beans. Fiber binds with the bile acids that are used to make cholesterol. Fiber isn't absorbed, so when it exits the body in the feces, it takes the bile acids with it. As a result, the body may end up with less cholesterol. Lima beans also contain insoluble fiber, which research studies have shown not only helps to increase stool bulk and prevent constipation, but also helps prevent digestive disorders like irritable bowel syndrome and diverticulosis.

Lower Your Heart Attack Risk

In a study that examined food intake patterns and risk of death from coronary heart disease, researchers followed more than 16,000 middle-aged men in the U.S., Finland, The Netherlands, Italy, former Yugoslavia, Greece and Japan for 25 years. Typical food patterns were: higher consumption of dairy products in Northern Europe; higher consumption of meat in the U.S.; higher consumption of vegetables, legumes, fish, and wine in Southern Europe; and higher consumption of cereals, soy products, and fish in Japan. When researchers analyzed this data in relation to the risk of death from heart disease, they found that higher consumption of legumes was associated with a whopping 82% reduction in risk!!

A study published in the *Archives of Internal Medicine* confirms that eating high fiber foods, such as lima beans, helps prevent heart disease. Almost 10,000 American adults participated in this study and were followed for 19 years. People eating the most fiber, 21 grams per day, had 12% less coronary heart disease (CHD) and 11% less cardiovascular disease (CVD) compared to those eating the least, 5 grams daily. Those eating the most water-soluble dietary fiber fared even better with a 15% reduction in risk of CHD and a 10% risk reduction in CVD.

Lima beans' contribution to heart health lies not just in their fiber, but in the significant amounts of folate, and magnesium these beans supply. Folate helps lower levels of *homocysteine*, an amino acid that is an intermediate product in an important metabolic process called the methylation cycle. Elevated blood levels of homocysteine are an independent risk factor for heart attack, stroke, or peripheral vascular disease, and are found in between 20-40% of patients with heart disease. It has been estimated that consumption of 100% of the daily value (DV) of folate would, by itself, reduce the number of heart attacks suffered by Americans each year by 10%.

Lima beans' good supply of magnesium puts yet another plus in the column of its beneficial cardiovascular effects. Magnesium is Nature's own calcium channel blocker. When enough magnesium is around, veins and arteries breathe a sigh of relief and relax, which lessens resistance and improves the flow of blood, oxygen and nutrients throughout the body. Studies show that a deficiency of magnesium is not only associated with heart attack but that immediately following a heart attack, lack of sufficient magnesium promotes free radical injury to the heart. Want to literally keep your heart happy? Eat lima beans.

Lima Beans Give You Energy to Burn While Stabilizing Blood Sugar

In addition to its beneficial effects on the digestive system and the heart, lima beans' soluble fiber helps stabilize blood sugar levels. If you have insulin resistance, hypoglycemia or diabetes, lima beans can really help you balance blood sugar levels while providing steady, slow-burning energy. Studies of high fiber diets and blood sugar levels have shown the dramatic benefits provided by these high fiber foods. Researchers compared two groups of people with type 2 diabetes who were fed different amounts of high fiber foods. One group ate the standard American Diabetic diet, which contained 24 grams of fiber/day, while the other group ate a diet containing 50 grams of fiber/day. Those who ate the diet higher in fiber had lower levels of both plasma glucose (blood sugar) and insulin (the hormone that helps blood sugar get into cells). The high fiber group also reduced their total cholesterol by nearly 7%, their triglyceride levels by 10.2% and their VLDL (Very Low Density Lipoprotein--the most dangerous form of cholesterol) levels by 12.5%.

Iron for Energy

In addition to providing slow burning complex carbohydrates, lima beans can increase your energy by helping to replenish your iron stores. A cup of lima beans contains 24.9% of the daily value for this important mineral. Particularly for menstruating women, who are more at risk for iron deficiency, adding to their iron stores with lima beans is a good idea—especially because, unlike red meat, another source of iron, lima beans are low in calories and virtually fat-free. Iron is an integral component of hemoglobin, which transports oxygen from the lungs to all body cells, and is also part of key enzyme systems for energy production and metabolism. And remember: If you're pregnant or lactating, your needs for iron increase. Growing children and adolescents also have increased needs for iron.

Manganese for Energy Production and Antioxidant Defense

Lima beans are a very good source of the trace mineral manganese, which is an essential cofactor in a number of enzymes important in energy production and antioxidant defenses. For example, the key oxidative enzyme *superoxide dismutase*, which disarms free radicals produced within the mitochondria (the energy production factories within our cells), requires manganese.

Protein Power Plus

If you're wondering how to replace red meat in your menus, enjoy the buttery taste of lima beans. Limas are a good source of protein, and when combined with a whole grain such as whole wheat pasta or brown rice, provide protein comparable to that of meat or dairy foods without the high calories or saturated fat found in these foods. And, when you get your protein from lima beans, you also get the blood sugar stabilizing and heart health benefits of the soluble fiber provided by these versatile legumes. A cup of lima beans will provide you with 13 grams of fiber and almost 15 grams of protein. All this for a cost of only 216 calories with virtually no fat.

Description

As lima beans are most often associated with succotash, a traditional Native American dish that combines this delicious bean with corn, many people think that they are native to the United States. Yet, one of lima beans' proposed places of origin, the place where the early European explorers were thought to have first discovered them, is actually reflected in its name "Lima," the capital of the South American country of Peru.

While there are many varieties of lima beans, the ones that are most popular in the U.S. are the Fordhook, commonly known as the butterbean, and the baby lima bean. The pod of the lima bean is flat, oblong and slightly curved, averaging about three inches in length. Within the pod reside two to four flat kidney-shaped seeds that are what we generally refer to as lima beans. The seeds are generally cream or green in color, although certain varieties feature colors such as white, red, purple, brown or black. Lima beans feature a starchy, potato-like taste and a grainy, yet slightly buttery, texture.

The scientific name for lima beans is *Phaseolus lunatus*.

History

Although lima beans have been cultivated in Peru for more than 7,000 years, historians are unsure whether they originated there or in Guatemala. Soon after Columbus' discovery of America, Spanish explorers noticed different varieties of lima beans growing throughout the South America, Central America and the Caribbean. They introduced them to Europe and Asia, while the Portuguese explorers introduced lima beans into Africa. Since lima beans can withstand humid tropical weather better than most beans, they have become an important crop in areas of Africa and Asia. Lima beans were introduced into the United States in the 19th century with the majority of domestic commercial production centered in California.

How to Select and Store

Dried lima beans are generally available in prepackaged containers as well as bulk bins. Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the lima beans are covered and that the store has a good product turnover so as to ensure the beans' maximal freshness. Whether purchasing lima beans in bulk or in a packaged container, make sure that there is no evidence of moisture or insect damage and that the beans are whole and not cracked.

Fresh lima beans are generally not widely available, although they can sometimes be found at farmers' markets or specialty grocery stores. If you have the opportunity to purchase them, choose ones that are firm, dark green and glossy, and free of blemishes, wrinkling and yellowing. If they have been shelled, you should inspect them carefully since they are extremely perishable. Look for ones that have tender skins that are green or greenish-white in color and do not have any signs of mold or decay.

If you purchase frozen lima beans, shake the container to make sure that the beans move freely and do not seem to be clumped together since the latter suggests that they have been thawed and then refrozen.

Store dried lima beans in an airtight container in a cool, dry and dark place where they will keep for up to six months. If you purchase the beans at different times, store them separately since they may feature varying stages of dryness and therefore will require different cooking times. As cooked lima beans are very perishable, they will only keep fresh for one day even if placed in a covered container in the refrigerator.

Fresh lima beans should be stored whole, in their pods, in the refrigerator crisper where they will keep fresh for a few days. Frozen lima beans do not need to be thawed before being cooked.

How to Enjoy

A Few Quick Serving Ideas

- If you can find whole lima beans in the market, you can serve them as an appetizer sprinkled with seasoning just like edamame (whole soy bean pods).
- Mix puréed lima beans with chopped garlic and your favorite fresh herbs. Use this spread as a sandwich filling or a dip for crudité.
- The heartiness of lima beans make them a great soup bean, especially when added to a soup that features root vegetables such as carrots, turnips, beets, and/or rutabagas.
- For a twist on the traditional native American dish succotash, make lima bean burritos. Fill corn tortillas with lima beans and corn kernels, and then top with chopped tomatoes, avocado and scallions.
- Blend cooked lima beans and sweet potatoes together. Serve this tasty dish on a plate accompanied by your favorite grain and fresh vegetable.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Lima Beans, cooked
1.00 cup
188.00 grams

Calories: 216
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
molybdenum	141.00 mcg	313	26.1	excellent
fiber	13.16 g	53	4.4	very good
copper	0.44 mg	49	4.1	very good
manganese	0.97 mg	49	4.0	very good
folate	156.04 mcg	39	3.2	good
phosphorus	208.68 mg	30	2.5	good
protein	14.66 g	29	2.4	good
potassium	955.04 mg	27	2.3	good
vitamin B1	0.30 mg	25	2.1	good
iron	4.49 mg	25	2.1	good
magnesium	80.84 mg	20	1.7	good
vitamin B6	0.30 mg	18	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Miso

What's New and Beneficial About Miso

- Miso is typically considered to be a high-sodium food, since one teaspoon of miso often contains 200-300 milligrams of sodium. However, recent research has shown that in spite of its high-sodium content, miso does not appear to affect our cardiovascular system in the way that other high-sodium foods sometimes can. In recent animal studies, for example, identical concentrations of salt (sodium chloride) obtained from miso versus table salt were discovered to have very different impacts on blood pressure. High-salt diets that derived their high salt level from table salt raised blood pressure in these animal studies, but high-salt diets that derived their high salt from miso did not. Recent human studies on miso intake among Japanese adults have also shown that miso-containing diets tend to lower risk of cardiovascular problems, despite the high-salt content of miso. Reasons for this unique relationship between miso and our cardiovascular system are not yet clear. However, some researchers have speculated that the unique soy protein composition of miso (including peptide building-blocks of protein that get formed from soy proteins when the beans are fermented) is one of the key reasons for the cardiovascular support provided by miso. Since miso is seldom eaten alone, other cardio-supportive foods in miso soups and miso stir-fries might also play an important role in these research findings.
- Some of the health benefits provided by soy foods depend on the ability of bacteria or other micro-organisms to break down two of the soy's isoflavones - daidzein and genistein—into related compounds (for example, equol). Interestingly, recent research has shown that many different strains of the fungus *Aspergillus oryzae*—by far the most widely-used fungus in the fermentation of miso—are capable of breaking down both daidzein and genistein. This finding is great news for anyone who already enjoys miso, or is considering adding miso to their diet. If micro-organisms used in miso fermentation don't break down some of the daidzein and genistein into other compounds like equol, it's up to the micro-organisms in our digestive tract to do so. While it is fantastic when we have the right balance of micro-organisms in our digestive tract to help us get optimal nourishment and health benefits from our food, those conditions don't always hold true. So it can be very helpful when a miso-fermenting fungus like *Aspergillus oryzae* helps breaks down the daidzein and genistein before the miso ever reaches our digestive tract!
- The list of research-documented antioxidants in miso is growing! In addition to conventional antioxidants like the minerals zinc and manganese, miso is now known to contain phytonutrient antioxidants including phenolic acids like ferulic, coumaric, syringic, vanillic, and kojic acid. Particularly interesting are new additions to the list of miso antioxidants that are related to its fermentation. In several recent studies, the amount of some specific antioxidants in miso appears to increase when fermentation is carried out for a longer period of time. DDPH (2,2,-diphenyl-1-picrylhydrazyl) antioxidants appear to be one category of miso antioxidants that increases with prolonged fermentation. These particular free radical scavengers may be more plentiful in miso that has been fermented for many months—or even several years—in comparison to miso that has only been fermented for one to three months. While the jury is still out on the overall antioxidant benefits of miso pastes with varying lengths of fermentation time, the jury is not out on the impressive antioxidant benefits that are provided by this widely enjoyed food.

WHFoods Recommendation

We encourage you to think about miso made from soybeans as part of your legume intake. Like other legume-based foods, soy miso is a good source of fiber and protein and a great way to increase your overall nourishment.

Many public health organizations—including the American Diabetes Association, the American Heart Association, and the American Cancer Society—recommend legumes (the category in which soybeans are classified) as a key food group for preventing disease and optimizing health. The 2005 Dietary Guidelines for Americans developed by the U.S. Department of Health and Human Services (USDHHS) and the U.S. Department of Agriculture (USDA) recommends 3 cups of legumes per week (based on a daily intake of approximately 2,000 calories). Because 1 serving of legumes was defined as 1/2 cup cooked, the Dietary Guidelines for Americans come very close to this as they recommend of 1/2 cup of cooked legumes on a daily basis. Based on our own research review, we believe that 3 cups of legumes per week is a very reasonable goal for support of good health. However, we also believe that optimal health benefits from legumes may require consumption of legumes in greater amounts. This recommendation for greater amounts is based upon studies in which legumes have been consumed at least 4 days per week and in amounts falling into a 1-2 cup range per day. These studies suggest a higher optimal health benefit level than the 2005 Dietary Guidelines: instead of 3 cups of weekly legumes, 4-8 cups would become the goal range. Remember that any amount of legumes is going to make a helpful addition to your diet.

When adding soy miso to a soup or stir-fry, you can treat two tablespoons of soy miso as the equivalent of approximately one-quarter cup of a legume. But rather than trying to replace your intake of other legumes (like whole soybeans or black beans or lentils) with soy miso, we recommend that you think about soy miso as a highly nutritious addition to your diet that is helping to maximize your health benefits from the legume family of foods.

We recommend selection of certified organic soy miso. For miso produced within the U.S., one of the major reasons we like certified organic soy miso is the widespread use of genetic modification in non-organic soybeans. Genetically modified (GM) soybeans have reached 90% market penetration in the U.S. For miso produced in other countries like Japan or Korea, even though the likelihood of genetic modification might be less, we still like certified organic soy miso due to the lower risk of unwanted contaminants like pesticides. In the case of non-U.S. soy miso, you may not find the USDA organic seal, but you should still look for the words "certified organic" or "organic certified" on the label.

Miso,
1.00 TBS
(17.19 grams)

Calories: 34
GI: not available

Nutrient	DRI/DV
copper	8%
manganese	8%
vitamin K	6%
protein	4%
zinc	4%
phosphorus	4%
fiber	4%
omega-3 fats	3%
choline	3%
vitamin B2	3%

Health Benefits

In comparison to research on soybeans and their overall health benefits, research specific to miso is much less common. In addition, research on miso is complicated by the fact that human intake of miso can be difficult to measure in isolation since miso is usually consumed as part of a soup, stir-fry, or other dish. (For example, when participants in a study provide information about their intake of miso soup and scientists analyze the nutritional and health benefits provided by miso, the outcome can be confusing since other foods contained in the miso soup like tofu or sea vegetables might also have been responsible for the nutritional and health benefits.) Still, as an overall observation, we believe that intake of soy miso shows a preponderance of health benefits and perhaps even stronger health benefits than soyfoods in general. We also suspect that these potentially stronger health benefits may be related to fermentation of soy miso by micro-organisms like the fungus *Aspergillus*.

Overall Nutrient Benefits

Soy miso is a very good source of manganese and copper as well as a good source of zinc (all three are important mineral antioxidants). It is also a very good source of the mineral phosphorus as well as a good source of protein and dietary fiber. In addition to these conventional nutrients, soy miso is also an important source of phytonutrient antioxidants including phenolic acids like ferulic, coumaric, syringic, vanillic, and kojic acid.

An especially interesting group of antioxidants in soy miso is the group of antioxidants related to miso fermentation. In several recent studies, the amount of some specific antioxidants in soy miso appears to increase when fermentation is carried out for a longer period of time. DDPH (2,2,-diphenyl-1-picrylhydrazyl) antioxidants appear to be one category of miso antioxidants that increase with prolonged fermentation. These particular free radical scavengers may be more plentiful in miso that has been fermented for many months—or even several years—in comparison to miso that has only been fermented for one to three months. food.

Like other soy-based foods, miso can provide us with a wide variety of phytonutrients. Many of these phytonutrients can function as antioxidants and anti-inflammatory substances. Due to differences in starting ingredients, micro-organisms used for fermentation, and total fermentation time, not all of the phytonutrients listed below are contained in all varieties of soy miso. But the list below provides a good overview of substances found in all forms of soy miso combined:

- Flavonoids and Isoflavonoids
    - daidzein
    - genistein
    - malonylgenistin

    - malonyldaidzin
- Phenolic Acids
    - Caffeic acid
    - Coumaric acid
    - Ferulic acid
    - Gallic acid
    - Sinapic acid
- Phytoalexins
    - glyceollin I
    - glyceollin II
    - glyceollin III
- Phytosterols
    - beta-sitosterol
    - beta-stigmasterol
    - campestrol
- Proteins and Peptides
    - defensins
    - glycinin
    - conglycinin
    - lunacin
- Saponins
    - soyasaponins (group A and group B)
    - soyasapogenols

Cardiovascular Benefits

Most of the heart-related research that we have seen on miso has involved population groups in Japan, and so it is difficult to say if these research findings also hold true for other population groups. In one large study involving 40,462 Japanese participants and lasting for more than 10 years, intake of miso was found to associated with decreased risk of one major type of stroke (cerebral infarct, or CI). This health benefit from miso held true despite miso also emerging as a major source of dietary salt in the study. These findings are fascinating, because ordinarily, a certain percentage of the Japanese population would be expected to be salt-sensitive and to have blood pressure undesirably increased by high intake of salt. Increase in blood pressure, in turn, would be expected to be a possible risk factor for CI. Yet miso was been found to *lower* risk of CI—a result that is unusual for a high-sodium food.

Animal studies have repeatedly shown this same result for miso versus table salt intake. Animals consuming a 2.3% table salt (sodium chloride) diet and animals consuming a 2.3% salt-from-miso diet have *not* experienced the same results. Salt-from-miso diets have *not* been found to raise blood pressure, even when they provide an equal amount of salt as high table salt diets. Researchers speculate that the difference may be related to a combination of factors, including soy proteins, peptides, isoflavones, and diverse antioxidants found in soy miso. In addition, researchers point to the potentially key role of fermentation in transforming soybean content and rendering it more capable of cardiovascular support. Further research is needed to clarify all of these issues.

Anti-Cancer Benefits

This area of soy miso research remains controversial. On the one hand, we know that soy miso contains the isoflavone genistein, and we know that dietary intake of genistein is associated with decreased risk of certain cancers, including prostate cancer. Yet at the same time, we also have studies on soy miso intake that show no association between prostate cancer risk and level of soy miso consumed.

Or, to take another controversial example: if individuals who consume daidzein (an isoflavone found in soyfoods and other types of food) have the right type of intestinal bacteria inside of their digestive tract, we know that they will end up having some of this dietary daidzein transformed by their intestinal bacteria into a related compound called equol. We also know that micro-organisms used to ferment soy miso (including many different strains of the fungus *Aspergillus oryzae*) are capable of turning daidzein into equol during miso fermentation. In this way, soy miso can end up containing equol even before we eat it!

This conversion of daidzein into equol by *Aspergillus* during miso fermentation was originally thought to have some reliable cancer-preventive benefits, but studies in this area have not reflected such a result. For example, in a study measuring risk of breast cancer among Japanese women, intake of miso soup was not found to reduce risk. Other studies have show a similar lack of risk reduction for colorectal cancer and prostate cancer based on intake of miso soup.

We have not seen any research studies specific to miso showing *increased* risk of cancer in any form. However, we are also unable to describe any clear anti-cancer benefits for soy miso based on the studies that we have seen. It's difficult for us to imagine negative consequences when taking a whole food like whole soybeans and allowing them undergo natural fermentation under safe conditions. We would expect a naturally fermented whole food to provide outstanding health benefits, including anti-cancer benefits.

However, soy miso is definitely a challenging food to research. As mentioned earlier in this section, consumption of miso can be difficult to measure in isolation since miso is usually consumed as part of a soup, stir-fry, or other dish. In addition, miso is often consumed in relatively small amounts in comparison with other foods. We hope that researchers will continue to investigate possible anti-cancer benefits from miso intake, and devote more attention to this uniquely fermented form of soy.

Digestive Benefits

In some ways, it's accurate to think about soy miso as a food that has been "pre-digested." That's because *Aspergillus* and other micro-organisms used in fermentation of soy miso can help metabolize proteins, carbohydrates, and fats found in soybeans and transform them into smaller molecules that may be more easily digested. In addition, depending on processing and fermentation methods, some soy miso can contain "friendly" bacteria like lactic acid bacteria (including various species of *Lactobacillus*) that might be helpful in supporting intestinal microflora. We have not seen large-scale, human research studies showing benefits of soy miso consumption for the digestive tract, but we would expect such studies to show digestive benefits based on the above factors. Hopefully, more attention will be given in future research studies to soy miso and its potential digestive benefits.

Fermented Soy Foods and Vitamin K

As described throughout this Health Benefits section, much of the nutrient support we get from fermented soy miso depends on the micro-organisms used in fermentation. While *Aspergillus oryzae* is often a premier micro-organism used in miso fermentation, other micro-organisms—including bacteria—can be highly important. *Bacillus subtilis* is one of these bacteria, and it is more commonly used in fermentation of Chinese miso than in Japanese, Korean, or Indonesian versions of this fermented soy food.

From a health standpoint, one of the reasons that *Bacillus* bacteria are so interesting is their ability to create a form of vitamin K called menaquinone-7 (MK-7). Vitamin K (in all forms) is an important nutrient for bone health. Sufficient intake of vitamin K is associated with decreased risk of osteoporosis, since this vitamin is involved with maintenance of bone mineral density and also with shaping of bone structure (through gamma-carboxylation). In the case of MK-7 (the form of vitamin K produced by *Bacillus* bacteria, and a member of the vitamin K2 menaquinone family), we know that higher levels of MK-7 in the blood correspond to lower risk of hip fracture in older Japanese women, and that higher MK-7 levels correspond to increased intake of soy foods that have been fermented with *Bacillus* bacteria. One fascinating aspect of *Bacillus*-fermented soy foods is the potential ability of these bacteria to stay alive in our lower intestine after these foods are consumed. We've seen one study in which 1.6-20 million *Bacillus* bacteria (per gram of feces) were found to remain alive up to 6 days following consumption of natto. If *Bacillus* bacteria from fermented soy foods can remain alive in our digestive tract, they may keep providing us with vitamin K benefits many days after their consumption.

It's important to remember that *Bacillus* bacteria are not used in production of all miso, and it can be difficult to determine which miso products have been fermented with the help of these bacteria. (Sometimes a call to the manufacturer may still not result in a clear answer here.) Our recommendation here is that you consider selection of Chinese miso products if you want to enjoy miso in your meal plan and you are paying special attention to your vitamin K intake, since Chinese miso is more likely to have been fermented with *Bacillus* bacteria.

Description

Miso is a Japanese word that means "fermented beans." Miso is usually found in the form of a thick paste, and the beans used during fermentation are almost always soybeans. During the soybean fermentation process, grains like barley, rice, or buckwheat might be added to achieve a certain flavor or other desired attribute, but in most situations, soybeans serve as the basis for miso fermentation. (This basic role of soybeans in preparation of miso can sometimes be overlooked because many varieties of miso may take on the name of their added ingredients, like "barley miso" or "rice miso." Yet virtually all of these miso varieties will contain soybeans as a basic ingredient.)

It's worth noting that under some circumstances, you might hear the word "miso" being used to refer to fermentation of a food other than soybeans. A good example is "fish miso." In this case, the term "miso" is being used to refer to the process of fermentation rather than the food being fermented. "Fish miso" is a term used to describe fish that has been fermented using the same basic fermentation process that can be used to produce soy miso, barley miso, or rice miso.

This use of the word "miso" in relationship to fish is important, because it tells us something very special about the miso fermentation process. For many miso eaters, the magic of miso lies in the micro-organism used for its fermentation: *Aspergillus oryzae*. This micro-organism is a particular type of fungus (a filamentous fungus, also called a "mold") that plays a special role in Japanese and other Asian cuisines. Long before scientists had developed ways of identifying and naming fungi like *Aspergillus*, cultures in China and Japan had developed special methods of fermenting soybeans (and other foods) that were practical and could be reproduced (assuring that the same mold was used, even though this mold was not yet scientifically identified). "Koji" was the term used to describe the end result when foods were fermented in this special way.

When scientists eventually discovered that the *Aspergillus* fungus was the key micro-organism involved with koji fermentation, the word "koji" took on a second meaning. While remaining the name for the end-stage product, it also became the name for the *Aspergillus* fungus itself. Therefore, you can now hear the word "koji" being used to refer to end-products of *Aspergillus* fermentation like miso or sake or soy sauce, as well as to the *Aspergillus* mold itself. You can also hear the word "koji" being used to refer to a grain-based starter that is used in the production of the above foods (including soy miso). When "koji" is used to refer to this starter, *Aspergillus* mold has usually been added to rice that has been pre-soaked and pre-cooked. The result is of this *Aspergillus*-fermented rice is called "koji." For a second stage fermentation into miso, "koji" starter is then added to soybeans that have also been soaked and cooked, and the entire mixture is allowed to age and ferment into miso. As you can see, the word "koji" can take on a variety of meanings. But these different meanings tell us something important about miso, namely, the special role played by the *Aspergillus* fungus in its fermentation.

Despite this primary focus on *Aspergillus* mold in fermentation miso, other micro-organisms are sometimes used in addition to *Aspergillus* during miso fermentation. The fungus *Zygosaccharomyces rouxii* is one of these micro-organisms. Other fungi include *Pichia guilliermondii*, *Clavispora lusitaniae*, *Absidia corymbifera*, and *Candida etchellsii*. Bacteria may also be used in the fermentation process. In the case of Japanese fermented soy pastes, *Tetragenococcus halophilus* and *Staphylococcus gallinarum* are bacteria sometimes used in fermentation. In the case of Chinese fermented soy pastes, species of *Bacillus* bacteria are more commonly used.

The texture of miso is usually paste-like and relatively thick, along the lines of peanut butter. But the color and taste can vary widely, depending on many fermentation-related factors. In terms of color, the lightest color miso is usually white or beige. This lighter color is often due to inclusion of a large amount of white rice during the fermentation process. When the word "koji" is used to refer to a miso starter made from rice and *Aspergillus*, white miso is also sometimes described as containing a large amount of koji. (If the koji has been made from *Aspergillus* fermentation of roasted rice flour, it may become light brown in color, but is often still included in the category of white miso.)

Another factor contributing to lighter color of white miso is shorter fermentation time. White miso is usually fermented for a much shorter period of time than darker-colored miso. (In some cases, a white miso may be fermented for a time period as short as several weeks, while a dark miso might be fermented for many months or even several years.) In terms of taste, white miso is usually the sweetest variety of miso. Some people also consider it to be the most versatile for cooking since it lacks the stronger flavors found in darker varieties of miso. In Japanese, the name for white miso is "shiromiso." When a miso like white miso is made with a large amount of rice, you may also hear it being referred to as "kome miso," since "kome" is the word for rice in Japanese.

When soybeans are fermented together with barley, the result is usually a miso that is yellow (or very light brown) in color. Since the Japanese word "mugi" can be used to refer to the general category of cereal grains (including barley and wheat), you will sometimes hear yellow miso being referred to as "mugi miso." Sometimes a small amount of white rice is also included during fermentation of yellow miso. One very popular yellow miso is Saikyo miso, traditionally made in the south-central region of Japan (the Kansai region).

In terms of color, the next major category of miso is red miso, sometimes called "akamimso" since "aka" means "red" in Japanese. Red miso may actually be a very dark brown or reddish brown in color, and it's usually (but not always) more salty than white or yellow miso. If a red miso is actually a very dark reddish brown in color, the brownish color may be the result of soybeans having been steamed prior to fermentation. While barley, rice and other grains may be used in the production of red miso, it is usually characterized by a very high percentage of soybeans, and for this reason is sometimes referred to as "mame miso" (since "mame" means "bean" in Japanese).

Dark brown and red miso usually get their strong flavors from longer periods of fermentation. In some cases, fermentation or dark soy miso may involve three years or longer. For example, Hatcho miso made by the Hatcho Miso Company in Okazaki, Japan (Aichi prefecture) is fermented in 200-year-old vats over a period of three winters.

Remember that regardless of the many names you may hear for different varieties of miso, virtually all include soybeans as a basic ingredient.

Other names you might hear for different varieties of miso include:

- genmai miso (brown rice-containing miso)
- soba miso or sobamugi miso (buckwheat-containing miso)
- taima miso (hemp seed-containing miso)
- natto miso (chutney-type miso that usually containing barley and ginger)

In China, miso is usually referred to as "taucheo," "dajiang," "doujiang" or just "jiang." In Korea, miso may be referred to as "jang" or "dwenjang." In Indonesia it is called "tautjo" or "tauco."

Given this rich history of miso varieties and names across Asia, the Codex Coordinating Committee for Asia (CCASIA, part of the Food and Agriculture Organization/World Health Organization of the United Nations) has actually set food quality standards for fermented soy paste that include fermentation by naturally-occurring or cultivated micro-organisms and other production factors. While the United States is a member of the Codex Commission that works to help develop international food standards, we're not aware of any commercially available miso products in the U.S. that show compliance with CCASIA standards

on their labeling. Still, we are glad to see attention being paid by an international organization to the quality of this unique and much-loved fermented food.

History

The style of fermentation used with miso is most likely to have originated in China several thousand years ago. Following its development in China, this style of fermentation is believed to have made its way into Japan as early as the 10th century B.C. It's difficult to overestimate miso's rich history. From rulers and priests and Buddhist monks to military personnel and everyday citizens, miso found its way into the heart of many Asian cuisines very early in the development of the cuisines. It is especially popular in the form of miso soup (often containing tofu and sea vegetables as well).

One key event in miso's history was the development of a process that could keep the spores from the *Aspergillus* mold alive, uncontaminated, and practical to transfer from place to place. Ash from the burned leaves of certain hardwood trees turned out to be a helpful material for storing the mold spores (sometimes called conidiospores) and transporting them to miso fermentation facilities.

Today miso is produced worldwide, and not just in Asia. Much of the miso produced in Asia countries is actually consumed in Asian countries. In Japan, for example, approximately 1,600 facilities manufacture miso, and total production reaches about 600,000 tons per year. From this total amount, however, less than 1% is usually exported outside of the country. Many soy miso pastes available for sale in the U.S. have actually been made in the U.S., although it is also common to find soy miso imported from Japan and Korea.

How to Select and Store

Miso is generally sold in tightly sealed plastic or glass containers. Some stores also sell it in bulk containers. To check for freshness, look for a sell-by date listed on the container. In addition, check the label to make sure there are no additives such as MSG.

The type of miso that you purchase should depend both on personal preference as well as intended use. Since darker color miso is stronger and more pungent in flavor, it is generally better suited for heavier foods. Lighter colored miso is more delicate and oftentimes more appropriate for soup, dressings, and light sauces.

Miso should be stored in the refrigerator in a tightly sealed container where it can keep for up to one year.

You can expect to find certified organic miso at most large supermarkets and natural food groceries. However, in practice, few organic miso pastes appear to display the USDA organic logo, mostly likely because the miso has been certified as organic by an independent third party. In the case of miso imported from Japan, organic certification often involves the Japanese Agricultural Standards (JAS) system. As is our recommendation for all WHFoods, we encourage you to purchase certified organic miso to lessen your risk of exposure to unwanted contaminants in your miso.

How to Enjoy

A Few Quick Serving Ideas

- Miso soup is quick and easy to prepare. Heat miso paste and water over low-medium heat. Eat as is or add in some traditional fixings including shiitake mushrooms, tofu, scallions, burdock, carrots, and daikon radish.
- Miso-tahini sandwiches are one of our favorites. To make your own, just spread miso on a piece of bread and then top with tahini. Enjoy as is or add sliced avocado.
- Use miso as an ingredient in marinades for meat, fish, poultry or game.
- Carry dried miso soup packets with you and enjoy them as a pick-me-up coffee substitute.
- Combine a little miso with olive oil, flax seed oil, ginger and garlic to make an Asian-inspired dressing that can be used on salads or cold grain dishes.

WHFoods Recipes That Feature Miso

- 5-Minute Miso Soup with Dulse (sea vegetable)
- Miso Stir-Fry
- Yummy Healthy Miso Soup

Safety

Miso and Food Allergies

Soybeans and the foods made from them, including miso, are among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions

In addition to the general allergy-related issues described above for soybean-containing foods, there is some research information specific to miso that is important to consider. First is the issue of protein P34. In some studies, this protein has been found to be one of the primary allergenic proteins in soy. However, at least one study on consumption of Korean miso has shown an undetectable level of protein P34 (with a detection level of 0.45 nanograms) in the miso, making fermented soybean paste a potentially less antigenic (allergy-causing) food than other forms of soy. This potentially reduced allergy risk from miso versus other soy foods makes sense to us. The fermentation process—especially over a period of time involving months or years—is likely to result in substantial modification of the proteins in soy, including potentially allergy-causing proteins like P34.

Some of the anti-cancer benefits of soy miso might be related to its potential strengthening of the immune system. (Weakened immune system function is a risk factor for many types of cancer.) Research studies show that during the soy miso fermentation process, there is significant potential for the creation of immuno-supportive substances. For example, we've seen a study in which soybeans fermented with the help of the bacterium *Tetragenococcus halophilus* showed the ability to increase T helper type immunity. Since immune system function often depends on a unique set of peptides (protein building blocks), transformation of soy proteins during fermentation is likely to provide the immune system with some helpful peptidesand eventually lowering our risk of cancer through added immune system support.

Miso and Thyroid Health

Along with the increasing presence of soy foods (such as miso) in grocery stores and on restaurant menus has come increasing controversy over soybeans and thyroid health. We're not surprised to find strong conflicting opinions in this area because scientific research on thyroid and soy is both complicated and inconclusive. We have written an extensive review of what we know - and what we don't know - about this important issue at this point. You find the article Soy Food and Thyroid Health here.

Miso and Acrylamide

When certain foods are cooked, their amino acids (protein building blocks) can interact with their simple sugars to form acrylamide. Acrylamide is a potentially toxic and potentially cancer-causing substance that can be naturally present in uncooked, raw foods in very small amounts, but can be formed in much large quantities in certain cooked foods. Grain-based coffee substitutes and fried potato chips are examples of foods that can contain high amounts of acrylamide. Even though you may find some websites listing miso as a high acrylamide food, we have not found any indexed journal research studies to support this finding. In fact, we have seen several studies on a related soy food - soy sauce - showing no detectable levels of acrylamide. The absence of high acrylamide levels in soy miso makes sense to us, because traditionally prepared soy miso does not undergo any high-heat processing, and also because the sugar content of miso is relatively low when soybeans make up the bulk of the miso ingredients. (Cooked soybeans contain only 2-3 grams of per half cup of total sugars.) In addition, traditionally fermented miso should definitely not be classified as a processed food that is comparable to potato chips or a grain-based coffee substitute. It is a natural food based on whole soybeans and natural processing of these who soybeans by micro-organisms. (For more detailed information on acrylamide and food, please see our article, What is acrylamide and how is it involved with food and health?)

Infants and Miso

One study from Japan has shown that breast-fed infants already diagnosed with atopic dermatitis (an inflammatory skin condition) experienced a worsening of dermatitis symptoms when their mothers consumed miso soup and soy sauce. We aren't sure how this research finding applies to healthy Japanese breastfeeding infants, or of course, to infants who are breastfeeding in the U.S. However, the result here does remind us of the importance of considering food sensitivity in the feeding of infants, and the potential difference between individual concerns for infants versus adults involving soy foods, including miso.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Miso, **1.00 TBS** **17.19 grams**				**Calories: 34** **GI: not available**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
copper	0.07 mg	8	4.1	very good
manganese	0.15 mg	8	3.9	very good
vitamin K	5.04 mcg	6	2.9	good
protein	2.01 g	4	2.1	good
zinc	0.44 mg	4	2.1	good
phosphorus	27.33 mg	4	2.1	good
fiber	0.93 g	4	2.0	good
omega-3 fats	0.08 g	3	1.8	good
vitamin B2	0.04 mg	3	1.6	good
choline	12.41 mg	3	1.5	good

World's Healthiest Foods Rating	**Rule**
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Navy beans

The navy bean got its current popular name because it was a staple food of the United States Navy in the early 20th century. These small white beans are perfect for making baked beans. Dry navy beans are available year-round in prepackaged containers as well as bulk bins. Canned navy beans are also available year round at local markets.

Navy beans are small, pea-sized beans that are creamy white in color. They are mild-flavored beans that are dense and smooth. Like other common beans, navy beans are one of 13,000 species of the family of legumes, or plants that produce edible pods. Combined with whole grains such as rice, navy beans provide virtually fat-free high quality protein.

Navy Beans, cooked
1.00 cup
(182.00 grams)

Calories: 255
GI: low

Nutrient	DRI/DV
fiber	76%
folate	64%
manganese	48%
copper	42%
phosphorus	37%
vitamin B1	36%
protein	30%
iron	24%
magnesium	24%

Health Benefits

Navy beans are an excellent source of cholesterol-lowering fiber, as are most other beans. In addition to lowering cholesterol, navy beans' high fiber content prevents blood sugar levels from rising too rapidly after a meal, making these beans an especially good choice for individuals with diabetes, insulin resistance or hypoglycemia. When combined with whole grains such as brown rice, navy beans provide virtually fat-free high quality protein. But this is far from all navy beans have to offer. Navy beans are a very good source of folate and manganese and a good source of protein and vitamin B1 as well as the minerals phosphorus, copper, magnesium and iron.

A Fiber All Star

Check a chart of the fiber content in foods and you'll see legumes leading the pack. Navy beans, like other beans, are rich in dietary fiber. Soluble fiber forms a gel-like substance in the digestive tract that combines with bile (which contains cholesterol) and ferries it out of the body. Research studies have shown that insoluble fiber not only helps to increase stool bulk and prevent constipation, but also helps prevent digestive disorders like irritable bowel syndrome and diverticulosis.

Lower Your Heart Attack Risk

In a study that examined food intake patterns and risk of death from coronary heart disease, researchers followed more than 16,000 middle-aged men in the U.S., Finland, The Netherlands, Italy, former Yugoslavia, Greece and Japan for 25 years. Typical food patterns were: higher consumption of dairy products in Northern Europe; higher consumption of meat in the U.S.; higher consumption of vegetables, legumes, fish, and wine in Southern Europe; and higher consumption of cereals, soy products, and fish in Japan. When researchers analyzed this data in relation to the risk of death from heart disease, they found that higher legume consumption was associated with a whopping 82% reduction in heart attack risk!

Navy beans' contribution to heart health lies not just in their fiber, but in the significant amounts of folate and magnesium these beans supply. Folate helps lower levels of homocysteine, an amino acid that is an intermediate product in an important metabolic process called the methylation cycle. Elevated blood levels of homocysteine are an independent risk factor for heart attack, stroke, or peripheral vascular disease, and are found in between 20-40% of patients with heart disease. It has been estimated that consumption of 100% of the daily value (DV) of folate would, by itself, reduce the number of heart attacks suffered by Americans each year by 10%. Just one cup of cooked navy beans provides 63.7% of the recommended daily intake for folate.

Navy beans' good supply of magnesium puts yet another plus in the column of its beneficial cardiovascular effects. Magnesium is Nature's own calcium channel blocker. When there is enough magnesium around, veins and arteries breathe a sigh of relief and relax, which lessens resistance and improves the flow of blood, oxygen and nutrients throughout the body. Studies show that a deficiency of magnesium is not only associated with heart attack but that immediately following a heart attack, lack of sufficient magnesium promotes free radical injury to the heart. Potassium, an important electrolyte involved in nerve transmission and the contraction of all muscles including the heart, is another mineral that is essential for maintaining normal blood pressure and heart function. Navy beans are ready to promote your cardiovascular health by being a good source of this mineral, too. A one cup serving of navy beans provides over 700 mg of potassium, making these beans an especially good choice to protect against high blood pressure and atherosclerosis.

Navy Beans Give You Energy to Burn While Stabilizing Blood Sugar

In addition to its beneficial effects on the digestive system and the heart, the dietary fiber found in navy beans helps stabilize blood sugar levels. If you have insulin resistance, hypoglycemia or diabetes, navy beans can really help you balance blood sugar levels while providing steady, slow-burning energy. Studies of high fiber diets and blood sugar levels have shown the dramatic benefits provided by these high fiber foods. Researchers compared two groups of people with type 2 diabetes who were fed different amounts of high fiber foods. One group ate the standard American Diabetic diet, which contained 24 grams of fiber/day, while the other group ate a diet containing 50 grams of fiber/day. Those who ate the diet higher in fiber had lower levels of both plasma glucose (blood sugar) and insulin (the hormone that helps blood sugar get into cells). The high fiber group also reduced their total cholesterol by nearly 7%, their triglyceride levels by 10.2% and their VLDL (Very Low Density Lipoprotein—the most dangerous form of cholesterol) levels by 12.5%.

Iron for Energy

In addition to providing slow burning complex carbohydrates, navy beans can increase your energy by helping to replenish your iron stores. Particularly for menstruating women, who are more at risk for iron deficiency, boosting iron stores with navy beans is a good idea—especially because, unlike red meat, another source of iron, navy beans are low in calories and virtually fat-free. Iron is an integral component of hemoglobin, which transports oxygen from the lungs to all body cells, and is also part of key enzyme systems for energy production and metabolism. And remember: If you're pregnant or lactating, your needs for iron increase. Growing children and adolescents also have increased needs for iron. A one cup serving of navy beans provides 24% of the daily recommended intake for iron.

Copper & Manganese—More Help with Energy Production Plus Antioxidant Defenses

Navy beans are a very good source of manganese and a good source of copper, trace minerals that are essential cofactors of a key oxidative enzyme called *superoxide dismutase*. Superoxide dismutase disarms free radicals produced within the mitochondria (the energy production factories within our cells).

Copper is also necessary for the activity of *lysyl oxidase*, an enzyme involved in cross-linking collagen and elastin, both of which provide the ground substance and flexibility in blood vessels, bones and joints.

As explained above, iron is primarily used as part of hemoglobin, the molecule responsible for transporting and releasing oxygen throughout the body. But hemoglobin synthesis also relies on copper. Without copper, iron cannot be properly utilized in red blood cells. Fortunately, Mother Nature supplies both minerals in navy beans.

Maintain Your Memory with Thiamin (Vitamin B1)

Thiamin participates in enzymatic reactions central to energy production and is also critical for brain cell/cognitive function. This is because thiamin is needed for the synthesis of acetylcholine, the important neurotransmitter essential for memory and whose lack has been found to be a significant contributing factor in age-related impairment in mental function (senility) and Alzheimer's disease. Alzheimer's disease is clinically characterized by a decrease in acetylcholine levels.

Protein Power Plus

If you're wondering how to replace red meat in your menus, become a fan of navy beans. These hearty beans are a good source of protein, and when combined with a whole grain such as whole wheat pasta or brown rice, provide protein comparable to that of meat or dairy foods without the high calories or saturated fat found in these foods. And, when you get your protein from navy beans, you also get the blood sugar stabilizing and heart health benefits of the soluble fiber provided by these versatile legumes. A cup of navy beans provides about 15 grams of protein.

Description

Navy beans are small, pea-sized beans that are creamy white in color. They are a mild-flavored bean that is dense and creamy.

History

Navy beans and other beans, such as pinto beans and black beans, are all known scientifically as *Phaseolus vulgaris*. They are referred to as "common beans" probably because they all derived from a common bean ancestor that originated in Peru.

From there, beans were spread throughout South and Central America by migrating Indian trades. Beans were introduced into Europe in the 15th century by Spanish explorers returning from their voyages to the New World. Spanish and Portuguese explorers brought them to Africa and Asia.

As beans are a very inexpensive form of good protein, they have become popular in many cultures throughout the world. The navy bean got its current popular name because it was a staple food of the United States Navy in the early 20th century. Today, the largest commercial producers of dried common beans, including the navy bean, are India, China, Indonesia, Brazil and the United States.

How to Select and Store

Dried navy beans are generally available in prepackaged containers as well as bulk bins. Just as with any other food that you may purchase in the bulk section, make sure that the bins are covered and that the store has a good product turnover rate to ensure maximal freshness.

Whether purchasing navy beans in bulk or in a packaged container, make sure there is no evidence of moisture or insect damage and that beans are whole and not cracked.

Canned navy beans can be found in most markets. Unlike canned vegetables, which have lost much of their nutritional value, there is little difference in the nutritional value of canned navy beans and those you cook yourself. Canning lowers vegetables' nutritional value since they are best lightly cooked for a short period of time, while their canning process requires a long cooking time at high temperatures. On the other hand, beans require a long time to cook whether they are canned or you cook them yourself. Therefore, if enjoying canned beans is more convenient for you, by all means go ahead and enjoy them. We would suggest looking for those that do not contain extra salt or additives. (One concern about canned foods is the potential for the can to include a liner made from bisphenol A/BPA. To learn more about reducing your exposure to this compound, please read our write-up on the subject).

Store dried navy beans in an airtight container in a cool, dry and dark place where they will keep for up to 12 months. Cooked navy beans will keep fresh in the refrigerator for about three days if placed in a covered container.

How to Enjoy

A Few Quick Serving Ideas

- Make a delicious sandwich spread by blending cooked navy beans in a food processor with olive or flax oil and your favorite herbs and spices.
- Add a protein punch to tomato soup by serving it with some pre-cooked navy beans mixed throughout.
- Mix cooked navy beans with olive oil, sage and garlic and serve on bruschetta.
- Combine navy beans with cooked roasted buckwheat and healthy sautéed onions and shiitake mushrooms for a hearty main dish.
- Use navy beans to make delicious and nutritious white chili.
- Add cooked and cooled navy beans to a salad of leeks and chard and top with a rosemary vinaigrette.

Safety

Oxalate Content

Navy beans consistently been determined to have high oxalate content. Oxalates are naturally occurring organic acids found in a wide variety of foods, and in the case of certain medical conditions, they must be greatly restricted in a meal plan to prevent over-accumulation inside the body. Our comprehensive article about oxalates will provide you with practical and detailed information about these organic acids, food, and health.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Navy Beans, cooked
1.00 cup
182.00 grams

Calories: 255
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
fiber	19.11 g	76	5.4	excellent
folate	254.80 mcg	64	4.5	very good
manganese	0.96 mg	48	3.4	very good
copper	0.38 mg	42	3.0	good
phosphorus	262.08 mg	37	2.6	good
vitamin B1	0.43 mg	36	2.5	good
protein	14.98 g	30	2.1	good
magnesium	96.46 mg	24	1.7	good
iron	4.30 mg	24	1.7	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Pinto beans

Combine the creamy pink texture of pinto beans with a whole grain such as brown rice and you have a virtually fat-free high quality protein meal. Dried pinto beans are generally available in prepackaged containers as well as bulk bins; both canned and dried pinto beans are available throughout the year.

Pinto beans have a beige background strewn with reddish brown splashes of color. They are like little painted canvases, à la Jackson Pollack; hence their name "pinto," which in Spanish means "painted." When cooked, their colored splotches disappear, and they become a beautiful pink color.

Pinto Beans, cooked
1.00 cup
(171.00 grams)

Calories: 245
GI: low

Nutrient	DRI/DV
molybdenum	285%
folate	74%
fiber	62%
copper	41%
manganese	39%
phosphorus	36%
protein	31%
vitamin B1	28%
vitamin B6	23%
magnesium	21%
potassium	21%
iron	20%

Health Benefits

Pinto beans are a very good source of cholesterol-lowering fiber, as are most other beans. In addition to lowering cholesterol, pinto beans' high fiber content prevents blood sugar levels from rising too rapidly after a meal, making these beans an especially good choice for individuals with diabetes, insulin resistance or hypoglycemia. When combined with whole grains such as brown rice, pinto beans provide virtually fat-free, high quality protein. But this is far from all pinto beans have to offer. Pinto beans are also an excellent source of molybdenum, a very good source of folate, and a good source of protein, vitamin B1, and vitamin B6 as well as the minerals copper, phosphorus, iron, magnesium, manganese, and potassium.

A Fiber All Star

Check a chart of the fiber content in foods and you'll see legumes leading the pack. Pinto beans, like other beans, are rich in fiber. A cup of cooked pinto beans provides over 15 grams. Soluble fiber forms a gel-like substance in the digestive tract that combines with bile (which contains cholesterol) and ferries it out of the body. Research studies have shown that insoluble fiber not only helps to increase stool bulk and prevent constipation, but also helps prevent digestive disorders like irritable bowel syndrome and diverticulosis.

Lower Your Heart Attack Risk

In a study that examined food intake patterns and risk of death from coronary heart disease, researchers followed more than 16,000 middle-aged men in the U.S., Finland, The Netherlands, Italy, former Yugoslavia, Greece and Japan for 25 years. Typical food patterns were: higher consumption of dairy products in Northern Europe; higher consumption of meat in the U.S.; higher consumption of vegetables, legumes, fish, and wine in Southern Europe; and higher consumption of cereals, soy products, and fish in Japan. When researchers analyzed this data in relation to the risk of death from heart disease, they found that higher legume consumption was associated with a whopping 82% reduction in heart attack risk!!

A study published in the *Archives of Internal Medicine* confirms that eating high fiber foods, such as pinto beans, helps prevent heart disease. Almost 10,000 American adults participated in this study and were followed for 19 years. People eating the most fiber, 21 grams per day, had 12% less coronary heart disease (CHD) and 11% less cardiovascular disease (CVD) compared to those eating the least, 5 grams daily. Those eating the most water-soluble dietary fiber fared even better with a 15% reduction in risk of CHD and a 10% risk reduction in CVD.

Pinto beans' contribution to heart health lies not just in their fiber, but in the significant amounts of folate, magnesium, and potassium these beans supply. Folate helps lower levels of homocysteine, an amino acid that is an intermediate product in an important metabolic process called the methylation cycle. Elevated blood levels of homocysteine are an independent risk factor for heart attack, stroke, or peripheral vascular disease, and are found in between 20-40% of patients with heart disease. It has been estimated that consumption of 100% of the daily value (DV) of folate would, by itself, reduce the number of heart attacks suffered by Americans each year by 10%.

Pinto beans' good supply of magnesium puts yet another plus in the column of its beneficial cardiovascular effects. Magnesium is Nature's own calcium channel blocker. When there is enough magnesium around, veins and arteries breathe a sigh of relief and relax, which lessens resistance and improves the flow of blood, oxygen and nutrients throughout the body. Studies show that a deficiency of magnesium is not only associated with heart attack but that immediately following a heart attack, lack of sufficient magnesium promotes free radical injury to the heart. Potassium, an important electrolyte involved in nerve transmission and the contraction of all muscles including the heart, is another mineral that is essential for maintaining normal blood pressure and heart function. Pinto beans are ready to promote your cardiovascular health by being a good source of this mineral, too. A one cup serving of pinto beans provides 746 mg of potassium and only 1.7 mg of sodium, making these beans an especially good choice to prevent high blood pressure and protect against atherosclerosis.

The effectiveness of potassium-rich foods such as pinto beans in lowering blood pressure has been demonstrated by a number of studies. For example, researchers tracked over 40,000 American male health professionals over four years to determine the effects of diet on blood pressure. Men who ate diets higher in potassium-rich foods, as well as foods high in magnesium and cereal fiber, had a substantially reduced risk of stroke.

Pinto Beans Give You Energy to Burn While Stabilizing Blood Sugar

In addition to its beneficial effects on the digestive system and the heart, the dietary fiber found in pinto beans helps stabilize blood sugar levels. If you have insulin resistance, hypoglycemia or diabetes, pinto beans can really help you balance blood sugar levels while providing steady, slow-burning energy. Studies of high fiber diets and blood sugar levels have shown the dramatic benefits provided by these high fiber foods. Researchers compared two groups of people with Type II diabetes who were fed different amounts of high fiber foods. One group ate the standard American Diabetic diet, which contains 24 grams of fiber/day, while the other group ate a diet containing 50 grams of fiber/day. Those who ate the diet higher in fiber had lower levels of both plasma glucose (blood sugar) and insulin (the hormone that helps blood sugar get into cells). The high fiber group also reduced their total cholesterol by nearly 7%, their triglyceride levels by 10.2% and their VLDL (Very Low Density Lipoprotein—the most dangerous form of cholesterol)levels by 12.5%.

Sensitive to Sulfites? Pinto Beans Can Help

Pinto beans are an excellent source of the trace mineral, molybdenum, an integral component of the enzyme sulfite oxidase, which is responsible for detoxifying sulfites. Sulfites are a type of preservative commonly added to prepared foods like delicatessen salads and salad bars. Persons who are sensitive to sulfites in these foods may experience rapid heartbeat, headache or disorientation if sulfites are unwittingly consumed. If you have ever reacted to sulfites, it may be because your molybdenum stores are insufficient to detoxify them.

Iron for Energy

In addition to providing slow burning complex carbohydrates, pinto beans can increase your energy by helping to replenish your iron stores. Particularly for menstruating women, who are more at risk for iron deficiency, boosting iron stores with pinto beans is a good idea—especially because, unlike red meat, another source of iron, pinto beans are low in calories and virtually fat-free. Iron is an integral component of hemoglobin, which transports oxygen from the lungs to all body cells, and is also part of key enzyme systems for energy production and metabolism. And remember: If you're pregnant or lactating, your needs for iron increase. Growing children and adolescents also have increased needs for iron.

Copper & Manganese—More Help with Energy Production Plus Antioxidant Defenses

Pinto beans are a very good source of manganese and a good source of copper, two trace minerals that are essential cofactors of a key oxidative enzyme called superoxide dismutase. Superoxide dismutase disarms free radicals produced within the mitochondria (the energy production factories within our cells).

Copper is also necessary for the activity of lysyl oxidase, an enzyme involved in cross-linking collagen and elastin, both of which provide the ground substance and flexibility in blood vessels, bones and joints.

As explained above, iron is primarily used as part of hemoglobin, the molecule responsible for transporting and releasing oxygen throughout the body. But hemoglobin synthesis also relies on copper. Without copper, iron cannot be properly utilized in red blood cells. Fortunately, Mother Nature supplies both minerals in pinto beans.

Maintain Your Memory with Thiamin (Vitamin B1)

The B vitamin, thiamin participates in enzymatic reactions central to energy production and is also critical for brain cell/cognitive function. This is because thiamin is needed for the synthesis of *acetylcholine*, the important neurotransmitter essential for memory and whose lack has been found to be a significant contributing factor in age-related impairment in mental function (senility) and Alzheimer's disease. Alzheimer's disease is clinically characterized by a decrease in acetylcholine levels.

Protein Power Plus

If you're wondering how to replace red meat in your menus, become a fan of pinto beans. These hearty beans are a good source of protein, and when combined with a whole grain such as whole wheat pasta or brown rice, provide protein comparable to that of meat or dairy foods without the high calories or saturated fat found in these foods. And, when you get your protein from pinto beans, you also get the blood sugar stabilizing and heart health benefits of the soluble fiber provided by these versatile legumes. A cup of pinto beans provides over 15 grams of protein.

Description

Pinto beans have a beige background strewn with reddish brown splashes of color. They are like little painted canvases, à la Jackson Pollack; hence their name "pinto," which in Spanish means "painted." When cooked, their colored splotches disappear, and they become a beautiful pink color with a delightfully creamy texture.

History

Pinto beans and other beans such as kidney beans, navy beans and black beans are all known scientifically as *Phaseolus vulgaris*. They are all referred to as "common beans" probably owing to the fact that they derived from a common bean ancestor that originated in Peru.

From there, beans were spread throughout South and Central America by migrating Indian trades. Beans were introduced into Europe in the 15th century by Spanish explorers returning from their voyages to the New World. Spanish and Portuguese traders brought them to Africa and Asia.

As beans are a very inexpensive form of good protein, they have become popular in many cultures throughout the world. Pinto beans are the most highly consumed dried bean in the United States. Today, the largest commercial producers of dried common beans are India, China, Indonesia, Brazil and the United States.

How to Select and Store

Dried pinto beans are generally available in prepackaged containers as well as bulk bins. Just as with any other food that you may purchase in the bulk section, make sure that the bins are covered and the store has a good product turnover rate to ensure maximal freshness.

Whether purchasing pinto beans in bulk or in a packaged container, make sure there's no evidence of moisture or insect damage and that beans are whole and not cracked.

Canned pinto beans can be found in many markets. Unlike canned vegetables, which have lost much of their nutritional value, there is little difference in the nutritional value of canned pinto beans and those you cook yourself. Canning lowers vegetables' nutritional value since they are best lightly cooked for a short period of time, while their canning process requires a long cooking time at high temperatures. On the other hand, beans require a long time to cook whether they are canned or you cook them yourself. Therefore, if enjoying canned beans is more convenient for you, by all means go ahead and enjoy them. We would suggest looking for those that do not contain extra salt or additives. (One concern about canned foods is the potential for the can to include a liner made from bisphenol A/BPA. To learn more about reducing your exposure to this compound, please read our write-up on the subject).

Store dried beans in an airtight container in a cool, dry and dark place where they will keep for up to 12 months. If you purchase pinto beans at different times, store them separately; they may feature varying stages of dryness and therefore will require different cooking times.

Cooked pinto beans will keep fresh in the refrigerator for about three days, if placed in a covered container.

How to Enjoy

A Few Quick Serving Ideas

- Use pinto beans in chili recipes in place of kidney beans.
- Blend together pinto beans with sage, oregano, garlic and black pepper for a delicious spread that can be used as a crudité dip or sandwich filling.
- Layer cooked pinto beans, chopped tomatoes and onions and shredded cheese on a tortilla. Broil in the oven until hot and cheese melts. Top with chopped avocado and cilantro.
- Add pinto beans to vegetable soups.
- Heat pinto beans together with cooked rice. Add cooked chopped vegetables such as carrots, zucchini and tomatoes. Season to taste and enjoy this simple-to-prepare one pot meal.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Pinto Beans, cooked
1.00 cup
171.00 grams

Calories: 245
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
molybdenum	128.25 mcg	285	21.0	excellent
folate	294.12 mcg	74	5.4	very good
fiber	15.39 g	62	4.5	very good
copper	0.37 mg	41	3.0	good
manganese	0.77 mg	39	2.8	good
phosphorus	251.37 mg	36	2.6	good
protein	15.41 g	31	2.3	good
vitamin B1	0.33 mg	28	2.0	good
vitamin B6	0.39 mg	23	1.7	good
magnesium	85.50 mg	21	1.6	good
potassium	745.56 mg	21	1.6	good
iron	3.57 mg	20	1.5	good

World's Healthiest Foods Rating	Rule
	DRI/DV>=75% OR

excellent	Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Soy sauce

What's New and Beneficial About Soy Sauce

- Recent studies suggest that soy sauce may be able to provide some digestive tract benefits. These benefits are related to the soy sauce fermentation process, and the creation of certain unique carbohydrates (called oligosaccharides) during this process. Some of the micro-organisms involved with soy sauce fermentation contain enyzmes that can break apart unique fibers (hemicelluloses) found in soybeans. When these hemicelluloses are broken apart, oligosaccharides are produced, and these oligosaccharides can help support the growth of "friendly" bacteria in our large intestine. (These bacteria include the lactic acid bacteria *Lactobacillus bulgaricus* and *Streptococcus thermophilus*.)
- Soy sauce is widely regarded as a salty food, and that perception is correct, since it's not unusual for a tablespoon of soy sauce to contain 1,000 milligrams of sodium. ("Salt" and "sodium" can be used pretty much interchangeably in this context, since table salt is composed of sodium and chloride; it's the sodium part that is involved with health problems in salt-sensitive individuals.) It's true that 1,000 milligrams of sodium is a large amount. In fact, it's nearly half of the recommended limit for sodium intake in an entire day. As a high-sodium food, soy sauce might be expected to be associated with increased risk of certain cardiovascular problems, including high blood pressure, since a certain percentage of individuals are salt-sensitive and experience blood pressure increases alongside of a high-salt diet. Yet, what's interesting is that recent research studies have suggested that soy sauce may be different than other high-salt foods with respect to our blood pressure and cardiovascular health. When soy sauce is fermented in the traditional way, many of the proteins found in the soybeans get broken down into smaller molecules called peptides. Some of these peptides act to inhibit the activity of angiotensin I-converting enzyme (ACE) that is needed to constrict our blood vessels. Our blood pressure tends to goes up when our blood vessels constrict because there is less room for our blood to flow through. By decreasing ACE activity, peptides in soy sauce may be able to help prevent this process from happening.

  It's still too early in the research process to give soy sauce any kind of "green light" in terms of its salt content, however. Anyone at risk of excessive salt intake or following a salt-restricted diet should still consult with a healthcare provider before including more soy sauce in a meal plan than would otherwise be allowed based on sodium content.

- Since soybeans are one of the eight food types most commonly associated with food allergy in the U.S., many people assume that soy sauce is a food with greater-than-usual potential to cause allergy problems. However, new research in this area suggests that soy sauce may be a far less allergenic form of soy that may actually provide support to our immune and inflammatory systems, which are typically involved in an allergic response. Two factors are especially fascinating in this new research. First is the breakdown of key allergy-triggering proteins in soybeans during the soy sauce fermentation process. (For example, an allergy-triggering protein in soybeans called *Gly m Bd 30K* gets broken down during soy sauce fermentation, and once this protein has been broken down into smaller parts, it can no longer trigger an allergenic response.) Second are the immune and inflammatory system benefits provided by unique soy sauce polysaccharides. Some of these carbohydrate-family molecules can lessen the activity of an enzyme called *hyaluronidase*. Overactivity of this enzyme is associated with increased inflammation and also with increased likelihood of allergic reaction. By lowering its activity, soy sauce polysaccharides may be able to lower the chances of an allergic reaction.

  In an equally fascinating twist, allergic reaction to the soy sauce itself might not be the only allergy risk that is lowered by these polysaccharides. In preliminary studies on small groups of students, supplementation with soy sauce polysaccharides has been found to lessen the occurrence of seasonal allergy symptoms. Students in the studies were given soy sauce polysaccharide supplements rather than soy sauce itself, with the polysaccharide content of the supplements being equivalent to approximately 2 ounces of soy sauce each day. We won't be able to know whether soy sauce itself will be equally effective without future studies. Still, the direction of this research is fascinating since it involves a food traditionally associated with heightened allergy risk. *Important Note*: persons with known or suspected soy allergy should still consult with a healthcare provider before making a decision about soy sauce in their meal plan.

WHFoods Recommendation

We highly recommend that you look for a soy sauce that is traditionally made (more details on what this means in the Description section). Also, it's important to find one that doesn't have artificial colors or flavors, including caramel coloring. Many supermarkets and Asian groceries now offer these additive-free varieties; natural food stores also are a very good source for them. If you are have a wheat sensitivity, wheat-free versions are available. These are sometimes labeled as "tamari." (Please note though that "tamari" is actually a broader class of soy sauce that reflects that it is made with either less or no wheat).

We recommend selection of certified organic soy sauce. For soy sauce produced within the U.S., one of the major reasons we like certified organic soy sauce is the widespread use of genetic modification in non-organic soybeans. Genetically modified (GM) soybeans have reached 90% market penetration in the U.S. For soy sauce produced in other countries like Japan, Korea, China, or Indonesia, even though the likelihood of genetic modification might be less, we still like certified organic soy sauce due to the lower risk of unwanted contaminants like pesticides. In the case of non-U.S. soy sauce, you may not find the USDA organic seal on the product, but you should still look for the words "certified organic" or "organic certified" on the product label.

An Important Message About Soy Sauce

We have placed soy foods (such as Soy Sauce) on our "10 Most Controversial WHFoods List." This list was created to let you know that even though some foods (like soy sauce) can make an outstanding contribution to your meal plan, they are definitely not for everyone. Soy foods can be difficult to find in high-quality form; can be more commonly associated with adverse reactions than other foods; and can present more challenges to our food supply in terms of sustainability. More details about our 10 Most Controversial WHFoods can be found here.

Soy Sauce, tamari
1.00 TBS
(18.00 grams)

Calories: 11
GI: not available

Nutrient	DRI/DV
manganese	5%
vitamin B3	4%
protein	4%
phosphorus	3%

Health Benefits

Overall Nutrient Benefits, Including Great Antioxidant Benefits

Thanks to the unique soy sauce fermentation process, this food is a rich mixture of nutrients not typically present in as concentrated amounts in other foods. Peptides from proteins (smaller and often bioactive protein "building blocks"), oligosaccharides and polysaccharides from carbohydrates (smaller starch-like components) and other fermentation-based nutrients are characteristically present in soy sauce. These breakdown components from protein and carbohydrate provide us with immune system, digestive system, and cardiovascular support.

Soy sauce also contains many different types of antioxidants. It is a good source of the mineral antioxidant manganese. It also contains valuable amounts of antioxidant phenolic acids including vanillic, syringic, coumaric, and ferulic acid. Isoflavonoid antioxidants in soy sauce include glycitein, daidzein, genistein, and genistin. (It's worth noting here, however, that the soy sauce production process may sometimes involve steps that lower the concentration of these isoflavonoids significantly and leave soy sauce with a much lesser concentration than other soyfoods.) Interestingly, some studies have shown more phytonutrient antioxidant density in soy sauce than red wine! In terms of its antioxidant benefits, soy sauce also appears to have a special ability for decreasing formation of hydrogen peroxide in the body. Since formation of hydrogen peroxide can be involved in unwanted oxidative stress, this special ability on the part of soy sauce may be an important antioxidant benefit. However, researchers have yet to determine exactly how soy sauce works to decrease hydrogen peroxide formation.

In our food rating system, we classify soy sauce as a "good" source of protein. But soy sauce actually deserves special mention in this protein category, since it ranks 9th among all of the World's Healthiest Foods in terms of protein density. In other words, if you obtain one gram of protein from soy sauce, it will cost you fewer calories than if you try to obtain one gram of protein from more than 100 other WHFoods. The protein density of soy sauce is actually greater than the protein density of animal foods like lamb, fish like salmon, or soybeans themselves!

Possible Digestive Tract Benefits

The unique fermentation process used to produce soy sauce may bring with it a long list of digestive tract benefits. First is the breakdown of large protein and carbohydrate molecules into smaller units, including dipeptides or polypeptides from proteins and oligosaccharides or polysaccharides from carbohydrates. This breakdown of proteins and carbohydrates would typically be carried out in our digestive tract by chemicals, enzymes, and bacteria. By carrying out breakdown through food fermentation, there may be less work needed in our digestive tract and that decreased "workload" may be helpful to our digestive tract under various circumstances.

Fermentation of soy sauce is also known to produce higher concentrations of oligosaccharides which support the growth of "friendly" bacteria in our large intestine. Here's how that process works: some of the micro-organisms involved with soy sauce fermentation contain enyzmes that can break apart unique fibers (hemicelluloses) found in soybeans. When these hemicelluloses are broken apart, oligosaccharides are produced, and these oligosaccharides can help support the growth of lactic acid bacteria including *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. These bacteria in turn help us obtain nutrients from food and provide for chemical balance inside of our large intestine.

Fermented Soy Foods and Vitamin K

Even though soy sauce is often fermented with the help of bacteria, as a general rule, *Bacillus* bacteria are not used in soy sauce fermentation. An exception to this rule involves the production of some Korean-style soy sauces, which do make use of *Bacillus* bacteria to help with fermentation.

From a health standpoint, one of the reasons why *Bacillus* bacteria - and especially one species called *Bacillus subtilis* - are so interesting is their ability to create a form of vitamin K2 called menaquinone-7 (MK-7). Vitamin K (in all forms) is an important nutrient for bone health. Sufficient intake of vitamin K is associated with decreased risk of osteoporosis, since this vitamin is involved with maintenance of bone mineral density and also with shaping of bone structure (through gamma-carboxylation). In the case of MK-7 (the form of vitamin K produced by *Bacillus* bacteria, and a member of the vitamin K2 menaquinone family), we know that higher levels of MK-7 in the blood correspond to lower risk of hip fracture in older Japanese women, and that higher MK-7 levels correspond to increased intake of soy foods that have been fermented with *Bacillus* bacteria. One fascinating aspect of *Bacillus*-fermented soy foods is the potential ability of these bacteria to stay alive in our lower intestine after these foods are consumed. We've seen one study in which 1.6-20 million *Bacillus* bacteria (per gram of feces) were found to remain alive up to 6 days following consumption of natto (a sticky form of whole soybeans that have been fermented with *Bacillus* bacteria). If *Bacillus* bacteria from fermented soy foods can remain alive in our digestive tract, they may keep providing us with vitamin K benefits many days after their consumption.

If vitamin K is a nutrient of special concern in your meal plan, you may want to consider Korean-style soy sauce as a preferred choice. However, we still recommend that you contact the manufacturer to determine what information is available about fermentation and vitamin K content, since Korean-style soy sauces are not always fermented with the help of *Bacillus* bacteria.

Other Health Benefits

Health benefits from soy sauce appear likely in several additional areas, even though these areas lack a large number of studies specific to soy sauce.

Immune and inflammatory system support from soy sauce is likely to come from its unique concentration of polysaccharides. Researchers have already identified at least one mechanism of action involved with this immune system support. Some polysaccharides within the carbohydrate family of molecules can lessen the activity of an enzyme called *hyaluronidase*. Overactivity of this enzyme is associated with increased inflammation and also with increased likelihood of allergic reaction. By lowering its activity, soy sauce polysaccharides may be able to lower the chances of an allergic reaction. The presence of unique polysaccharides in soy sauce appears to make soy sauce one of the least allergy-triggering forms of soy.

In this area of immune and inflammatory system support, preliminary studies suggest that soy sauce polysaccharides might be able to lower our risk of seasonal allergy symptoms. In these preliminary studies, small groups of students were given supplements containing soy sauce polysaccharides and were determined to experience fewer seasonal allergy symptoms following 4-8 weeks of supplementation. Students in the studies were given soy sauce polysaccharide supplements rather than soy sauce itself, with the polysaccharide content of the supplements being equivalent to approximately 2 ounces of soy sauce each day. Without additional studies involving soy sauce itself, we can't know if soy sauce will provide the same benefits as these polysaccharide supplements. Still, this research appears to point in the direction of immune and inflammatory system benefits from soy sauce as a food.

There has also been some preliminary research to suggest possible soy sauce benefits for prevention of type 2 diabetes. For soy foods in general, there is an association between dietary intake and risk of type 2 diabetes. This association makes sense because a major problem in the development of type 2 diabetes is loss of function in the beta cells of the pancreas which manufacture insulin. This loss of function is sometimes due to a process called "apoptosis" in which the cells undergo a type of pre-programmed shutdown. Intake of many different food phytonutrients can lower the risk of apoptosis in certain cells, and included in these phytonutrients are the isoflavonoids naturally present in soybeans. These interrelationships between soy isoflavonoids, pancreatic cell function, and type 2 diabetes make soybeans a logical choice for decreased risk of type 2 diabetes. However, in the specific case of soy sauce, these interrelationships don't make the same degree of sense because the soy sauce production process can sometimes lower the amount of isoflavonoids to a level far below the amount present in most other soyfoods. For this reason, the jury is still out in this area of potential health benefits.

Description

Soy sauce is a liquid made from soybeans (also known by the Latin name *Glycine max*) or a combination of soybeans and wheat. It can vary from light amber to dark brown in color (even though most of us are accustomed to seeing the dark brown versions). The thickness of soy sauce can also vary, because soy sauce is actually a liquid that gets pressed out of a semi-solid soybean "mash" consisting of soybeans that have been boiled, mashed, fermented, and aged over a lengthy period of time. One of the most popular types of soy sauce—*tamari*—actually gets its name from the Japanese verb "*tamaru*" which means to "accumulate" or "save" or "be stock" in Japanese. The liquid we call "soy sauce" is thus the fluid that accumulates when fermented soybean mash gets mechanically squeezed and pressed.

Due to the widespread popularity of soy sauce in Japan and the unique relationship between Japan and the United States, many of the Japanese names for soy sauce appear on product labels in U.S. groceries. The most general word for soy sauce in Japanese is *shoyu*, and you will often find this word on a product label. Within the shoyu family are three basic types of soy sauce. The deepest brown and most strongly aromatic type of shoyu is *koikuchi* shoyu. This product is also sometimes referred to as "dark soy sauce." It's relatively common for koikuchi to contain a mixture of 50% soybeans and 50% wheat in its composition. A very popular and common type of shoyu in the U.S. is somewhat less dark, less aromatic, and more viscous. It's made from a soybean-wheat mixture than contains only a small amount of wheat. *Tamari* shoyu is the name for this second type of soy sauce. Finally is a type of soy sauce that contains the greatest amount of wheat, a much lower amount of soy, and is lighter in color. This type of soy sauce is *shiro* shoyu. Shiro is also sometimes referred to as "light soy sauce."

A fascinating set of steps is involved with the traditional fermentation of soy sauce. First, whole soybeans are soaked, drained, and then boiled. (In the case of some soy sauce varieties, including many Korean varieties, the beans are also allowed to germinate prior to boiling.) The boiled soybeans are then cooled and inoculated with mold spores. (Molds are a type of fungus. Other types of fungus include mushrooms and yeasts.) The two types of molds used to inoculate the soybeans are *Aspergillus oryzae* and *Aspergillus sojae*. The soybean-mold combination is then cultivated for several days at approximately room temperature or slightly above. The beans are then mashed and combined with a salt brine. This mixture will be aged for several months, or in some cases, several years. As a final step in the process, the liquid will then be squeezed out of the aged mash, and it's that liquid that we recognize as soy sauce.

During the cultivation and aging steps in soy sauce production, several unique micro-organisms become involved in fermentation. Already mentioned are the very important molds (fungi) *Aspergillus oryzae* and *Aspergillus sojae*. Foods that have been inoculated with these mold spores and cultured are sometimes referred to as "koji," regardless of whether the inoculated foods are plant foods (like soybeans and grains) or animal foods or fish. You'll sometimes see the phrase "koji starter" being used to describe steps in the soy sauce production process, and this phrase may refer to inoculated soybeans or inoculated grains (usually wheat). But in any case, the special value of "koji" in Asian cuisines definitely attests to the value of the *Aspergillus* mold.

Bacteria are also involved in soy sauce fermentation. Because the *Aspergillus* mold needs oxygen to thrive, the first soy sauce fermentation steps usually involve more shallow containers to provide plenty of oxygen access. But later on, deeper vats are used that create lower-oxygen conditions that are more conducive to the growth of certain bacteria and yeasts. In the case of most Japanese soy sauces,*Tetragenococcus halophilus* is the most important of these bacteria, but other lactic acid bacteria may be used in the fermentation process, including numerous species of *Lactobacillus*. Yeasts may also be used to assist with fermentation, including the yeast *Saccharomyces cerevisiae*.

In the case of some soy sauce production, *Bacillus* bacteria are also used to help with fermentation. *Bacillus subtilis*, for example, is sometimes used in the fermentation of Korean-style soy sauce. As discussed in our Health Benefits section above, the use of *Bacillus* bacteria can result in unique health benefits since these bacteria are able to make a form of vitamin K2 (called MK-7).

As you can see, the soy sauce fermentation process is truly amazing; it involves the participation of molds, yeasts, and bacteria, and can take months or years to complete. The many unique flavors found in different varieties of soy sauce reflect this complex interaction of micro-organisms, as well as the varying amounts of soy and wheat used in soy sauce production. Unfortunately, it is possible to find products in the marketplace that have not been produced according to traditional fermentation and cultivation methods, and do not provide the health benefits of genuine soy sauce. For this reason, we recommend that you purchase soy sauce that has been prepared in the traditional way. In some cases, you will find information on the product label about the production process, including details about the length of fermentation and aging. In other cases, you will need to contact the manufacturer to determine this information. Two additional pieces of labeling information can also be helpful in finding a traditionally fermented soy sauce. One is the phrase "naturally brewed" on the label. This phrase isn't a guarantee of traditional fermentation, but it's usually a helpful indicator. Another helpful indicator is the phrase "no artificial colors or flavors" or "made only from natural ingredients." Once again, this labeling information doesn't give you a guarantee, but makes it more likely that your soy sauce was traditionally prepared.

In today's marketplace, it is also worth noting that many types of soy sauce traditionally containing wheat are available in wheat-free versions, including tamari. Also available are reduced sodium versions of many soy sauce types.

No description of soy sauce would be complete with a celebration of *umami*. Many people would describe "umami" as the basic unique taste of soy sauce, but from a Western science standpoint, this word actually refers to a special taste perception that is experienced not only with soy sauce but with other foods, including fish sauce, shrimp paste, mushrooms, sea vegetables, aged meats and cheeses, and other foods. Relatively recent research has shown that humans have receptors on certain taste buds for the unique flavor referred to as "umami." Alongside of our taste bud receptors for sweet, salty, sour, and bitter, we have receptors for what is usually referred to as "savory" and umami is that savory fifth taste. Food scientists have determined the food chemistry that is needed to provoke this umami taste. What's required is the combination of an amino acid (usually glutamate, but sometimes aspartate as well) with a nucleotide (usually inosine monophosphate or guanosine monophosphate). When coupled together, these particular molecules latch onto the receptors for "savoriness" on our taste buds. This chemical understanding of umami matches up extremely well with the actual food sensations experienced by humans. Sardines, tuna, bonito flakes (which are dried flakes made from a fish that is closely related to tuna), beef, and shrimp are all foods high in the nucleotide inosine, as well as being frequently high in glutamate. Mushrooms are high in the other umami-related nucleotide, guanosine, and can also contain substantial amounts of glutamate. It's worth noting that for many persons, the experience of soy sauce and other umami-rich foods extends beyond the mere chemistry of taste, and involves a much richer experience of these foods involving not only taste but also aroma as well as generalized satisfaction and pleasure that comes from consumption of these foods.

History

Like other soy foods, soy sauce has a long and wonderful history of use in many cuisines, especially cuisines in China, Japan, Korea, Vietnam, Thailand, Burma, Indonesi,a and the Philippines. The Chinese character "sho" appeared in recipes as early as the 1st century AD in China and referred to a fermented food either made from vegetables or alternatively from flesh or fish. Over the course of several hundred years, the food fermentation process used to create "sho" became more popular both inside and outside of China. In Japan, the word "shoyu" began to be used in reference to soybean-based pastes that had been fermented in this way. "Shoyu" is still the correct word in Japanese for referring in general to soy sauce (rather than to particular types of soy sauce, for example, tamari, shiro, or koikuchi).

During the earliest periods of soy sauce use, it's very likely that this "sauce" was not consumed in the form of a liquid but rather in the form of an unrefined paste. (The word "*moromi*" was often used in Japanese cuisine to refer to this early paste-like form of soy sauce. Today, this paste-like form of soy would often simply be described as "miso.") It may have taken as many as 500-1,000 years for soy sauce to become popular in the form of a true liquid.

Today, several thousand different companies are involved in soy sauce production worldwide. The world's largest soy sauce producer (Kikkoman Corporation headquartered in Tokyo, Japan) sells over 500 million liters of soy sauce per year.

How to Select and Store

Soy sauce is generally sold in sealed glass bottles. Some stores also sell it in bulk containers. Check the label to make sure that no additives, such as MSG, have been added. Look for the phrase "contains no artificial colors or flavors" on the label, as well as the phrase "naturally brewed." These phrases do not guarantee soy sauce production according to traditional methods, but they increase the likelihood of such production. We also encourage you to look for certified organic soy sauce, which is very likely to lower your risk of exposure to unwanted synthetic pesticides or soy sauce made from genetically engineered soybeans or wheat.

One unexpected difficult with selection of soy sauce in today's marketplace, however, is the availability of products that have not been produced according to traditional fermentation and cultivation methods. As a result, these products may not provide the health benefits of genuine soy sauce. From a product labeling standpoint, however, it can be tricky to determine the difference between a traditionally fermented soy sauce and a lower quality soy sauce. In some cases, you will find information on the product label about the soy sauce production process, including details about the length of fermentation and aging. In other cases, you will need to contact the manufacturer to determine this information. Two additional pieces of soy sauce labeling information can also be helpful in finding a traditionally fermented soy sauce. One is the phrase "naturally brewed" on the label. This phrase isn't a guarantee of traditional fermentation, but it's usually a helpful indicator. Another helpful indicator is the phrase "no artificial colors or flavors" or "made only from natural ingredients." Once again, this labeling information doesn't give you a guarantee, but makes it more likely that your soy sauce was traditionally prepared.

While most certified organic soy sauces are produced in keeping with traditional methods, there is no requirement by the U.S. Department of Agriculture that traditional methods be adhered to - only that organic rules (like the avoidance of most synthetic pesticides, sewage sludge fertilizers, genetically modified ingredients, and irradiated ingredients) be followed. So we recommend that you go beyond the criterion of "certified organic" in the case of soy sauce and also try to select traditionally fermented products.

The growing popularity of soy sauce in the U.S. marketplace has also led to the increasingly widespread availability of wheat-free and reduced sodium versions of this food. For example, it has become relatively common to find "wheat-free tamari" available in U.S. supermarkets, even though tamari is a type of soy sauce traditionally prepared with a small amount of wheat. You'll almost always find this information ("wheat-free" and/or "reduced sodium") prominently displayed on the product label.

Unopened soy sauce can be kept in a cool, dark place. Once the bottle is opened, soy sauce should be stored in the refrigerator.

How to Enjoy

A Few Quick Serving Ideas

- Use soy sauce as a seasoning when healthy sautéing vegetables.
- Combine soy sauce, garlic, and ginger and use as a marinade for baked tofu, tempeh, or chicken.
- Keep a container of soy sauce on the dinner table and use instead of table salt for seasoning foods.
- Serve brown rice with a Japanese flair by sprinkling some soy sauce, sesame seeds, and nori strips on top.

Safety

Soy Sauce and Salt

High salt content is perhaps the most common individual concern about intake of soy sauce. Technically, "high salt" in this case means "high in sodium," since table salt is formed from the elements sodium and chloride (and it's the sodium part of table salt that can increase blood pressure in sodium-sensitive individuals when consumed in excessive amounts). Since one tablespoon of soy sauce typically contains about 1,000 milligrams of sodium—nearly half of the recommended limit for sodium intake in an entire day—soy sauce is indeed a high-sodium food. As a high-sodium food, soy sauce might be expected to be associated with increased risk of high blood pressure. But interestingly, recent research studies have suggested that soy sauce may be different than other high-salt foods with respect to blood pressure and cardiovascular health. When soy sauce is fermented in the traditional way, many of the proteins found in the soybeans get broken down into smaller molecules called peptides. Some of these peptides act to inhibit the activity of angiotensin I-converting enzyme (ACE) that is needed to constrict our blood vessels. Our blood pressure tends to goes up when our blood vessels constrict, because there is less room for our blood to flow through. By decreasing ACE activity, peptides in soy sauce may be able to help prevent this process from happening.

It's too early in the research process to give soy sauce any kind of "green light" in terms of its salt content, however. Anyone at risk of excessive salt intake or following a salt-restricted diet should still consult with a healthcare provider before including more soy sauce in a meal plan than would otherwise be allowed based on sodium content.

Soy Sauce and Food Allergies

Soybeans and the foods made from them, including soy sauce, are among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions

Alongside of this well-established and broad-based concern about the potential for allergic response to soy foods in general is recent research to suggest that soy sauce might be a much less allergy-triggering form of soy. In addition, this recent research suggests that soy sauce might provide support to our immune system, which is involved in an allergic response. Two factors are especially fascinating in this new research. A lower risk of allergic response to soy sauce may be related to the breakdown of key allergy-triggering proteins in soybeans during the soy sauce fermentation process. For example, an allergy-triggering protein in soybeans called *Gly m Bd 30K* gets broken down during soy sauce fermentation, and once this protein has been broken down into smaller parts, it can no longer trigger an allergenic response.

In addition to this breakdown of allergy-triggering proteins during soy sauce fermentation, unique soy sauce polysaccharides may provide our immune system with special support. Some of these polysaccharides (which are carbohydrate-family molecules) can lessen the activity of an enzyme called *hyaluronidase*. Overactivity of this enzyme is associated with increased inflammation and also with increase likelihood of allergic reaction. By lowering its activity, soy sauce polysaccharides may be able to lower the chances of an allergic reaction. However, persons with known or suspected soy allergy should still consult with a healthcare provider before making a decision about soy sauce in their meal plan.

Soy Sauce and "Chinese Restaurant Syndrome"

Another concern that has been raised about soy sauce is its possible connection with what became known in the late 1960's as "Chinese restaurant syndrome." Chinese restaurant syndrome was the name given to symptoms of headache, lightheadedness, dizziness, or nausea experienced by some persons after consumption of meals in some restaurants that featured Asian-style cuisine. Early research into this phenomenon didn't provide any conclusive evidence about the reason for the symptoms, although many factors pointed to the very likely involvement of monosodium glutamate (MSG) used as a flavor enhancer during food preparation. Even though it is still not 100% clear whether MSG is the sole factor responsible for these post-meal symptoms, most current research has moved on from the idea of "Chinese restaurant syndrome" and has simply focused on adverse reactions to MSG (primarily nervous system changes). Since MSG is a chemical salt made from the amino acid glutamate, free glutamate is the main substance of concern when considering an MSG-related adverse food reaction. Furthermore, since glutamate is the primary free amino acid in soy sauce, it's logical to consider soy sauce as a potential trigger for MSG-type adverse reactions. However, most studies of soy sauce that we've seen show a very large difference between the amount of free glutamate present in MSG versus the amount of free glutamate present in soy sauce. For MSG, the amount is usually in the range of 700-750 milligrams per gram. That's about 70-75% free glutamate by weight. For soy sauce, the amount is usually in the range of 1-12 milligrams per gram—about 1.2% free glutamate by weight. This large difference may explain the reason why intake of soy sauce does not seem to be associated in research studies with symptoms like headache or lightheadedness in the same way as MSG. Still, persons with known or suspected sensitivity to MSG should consult with their healthcare provider when making a decision about the role of soy sauce in their diet.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Soy Sauce, tamari
1.00 TBS
18.00 grams

Calories: 11
GI: not available

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
manganese	0.09 mg	5	7.5	good
vitamin B3	0.71 mg	4	7.4	good
protein	1.89 g	4	6.3	good
phosphorus	23.40 mg	3	5.6	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Soybeans

What's New and Beneficial About Soybeans

- We recognize that soybean consumption is a matter of much current debate. There has been much written about it on the Internet, with claims that eating soybeans can endanger your health. To provide you with a comprehensive perspective on this topic, we have reviewed the research on soybeans. Throughout this food profile we have addressed the key controversial issues, focusing on them especially in our Health Benefits and Individual Concerns sections. Reading through this food profile you can explore our discovered insights into this traditional food, including how the research is quite different when it comes to whole soybeans versus isolated soybean derivatives and how fermented soybean foods may provide more benefits than unfermented ones. Read the full profile for more details.
- Researchers have recently asked a very simple question about soybeans: what would happen in terms of nutrition if U.S. citizens replaced their current intake of meat and dairy products with soy? Using previously collected information on the U.S. population and average U.S. dietary intake, these researchers determined that replacement of meat and dairy with soy would result in significantly improved intake of folate and vitamin K; larger amounts of calcium, magnesium and iron; and 4 additional grams of fiber per day. At the same time, replacement of all meat and dairy with soy would lower average cholesterol intake by 123 milligrams per day and lower average saturated fat intake by 2.4 grams per day. Protein would decrease somewhat (by approximately 8 grams per day, or 9% of average protein intake). Given the relatively high average daily intake of protein in the U.S. (which in some cases, is nearly double the Dietary Reference Intake level), this 9% decrease in total protein intake does not seem problematic to us—making this "soy substitution" seem like good nutritional trade-off. We're not advocating replacement of all meat and dairy foods with soy! High-quality meat and dairy foods can play a very supportive role in many diets. But alongside of the many controversies swirling around soybeans and health, we think it's important not to lose sight of the strong nutritional value of this legume.
- Soybeans have long been recognized as a plant food that, when compared with other plants, is relatively high in protein. Protein is the reason that soybeans have historically been called "meat of the field" or "meat without bones." But only recently have researchers taken a very close look at the protein content of soybeans and arrived at some fascinating conclusions. Even though soy protein is a plant protein and typically lower in certain amino acids (protein building blocks) than animal proteins like those found in chicken eggs or cow's milk, once adjustments have been made for digestibility and other metabolic factors, soybeans turn out to receive a protein quality rating that is equal to the ratings for egg or cow's milk. Along with this increasing interest in soy protein has come the discovery of very small and unique proteins in soy, typically referred to as "peptides." Examples of unique peptides in soybeans include defensins, glycinins, conglycinins and lunasin, and all are now known to provide us with health benefits, including benefits in the areas of improved blood pressure regulation, better control of blood sugar levels, and improved immune function.
- Because research studies have provided some mixed results about the impact of soy consumption on our cardiovascular system, researchers in the College of Medicine at the University of Kentucky recently analyzed results from 43 previously published studies involving on soy protein and risk of coronary heart disease (CHD). What they found was an overall decreased risk of CHD when approximately 30 grams of soy protein was consumed on a daily basis. Decreased LDL cholesterol was found to be an important part of this lowered risk. While we think it makes the most sense to consume soybeans in their whole food form (versus soy protein alone), and that daily protein intake should come from a variety of different foods, the findings in this study lend support to the conclusion that soy can play a beneficial role in support of cardiovascular health.
- When we think about antioxidant foods, the first foods that come to mind are usually vegetables. But recent research on soy has underscored many of the impressive antioxidant benefits that we get from this legume. No phytonutrient in soy has received more widespread attention than genistein—an isoflavone that has been extensively studied in relationship to cancer risk. Yet, genistein is a soy component that could easily be singled out for its antioxidant properties! Increased activity of antioxidant enzymes—including superoxide dismutase, glutathione peroxidase, catalase, and glutathione reductase—has now been linked to intake of genistein from soy. Another group of antioxidant phytonutrients called phenolic acids has also been recently investigated in soybeans. When we enjoy this antioxidant-rich legume, we also benefit from its phenolic acids, including caffeic, coumaric, ferulic, and sinapic acid.

WHFoods Recommendation

When including soybeans, try to stick with the whole food forms, and also consider giving preference to fermented versions like tempeh, fermented tofu, and soy miso.

Unfortunately, in the United States, we seldom consume soybeans in their whole natural form (either fresh or dried). Instead, we process soybeans by using hexane or other solvents to remove the oil (which can be sold as cooking oil or oil to be added to other processed foods), and then we take what's left over (defatted soy flour) and either (1) combine it with other proteins to make animal feed or (2) wash it with water to create soy protein concentrate. Soy protein concentrate becomes the source for two forms of soy that are even more processed: TVP, or textured soy protein that can be produced through a process called extrusion, and SPI (soy protein isolate), which can be produced by making the soy protein concentrate more solubilized. SPI is used in many low-fat soy milks.

All of the above processing steps create a soy product that is very different from the soybeans' whole food form. A full-fat soy milk, for example, can be made by simply cooking whole soybeans in water and using a cloth to strain the soymilk (liquid) from the fibrous part of the cooked beans. Tofu can be made from full-fat soy milk by using salts or acids to coagulate the milk into curds that can be pressed into "cakes." (Tofu can be further preserved through fermentation.) Natto is another good example of a whole food form of soybean. Natto can be made by taking whole soybeans, adding a bacteria called *Bacillus subtilis*, and giving the bacteria time to ferment the beans. Natto, tofu, and full-fat soymilk are whole food forms of soybean that stand in sharp contrast to processed forms like TVP and SPI.

Since genetically modified (GM) soybeans have reached 90% market penetration in the United States select organically grown soy products to avoid GMO.

Public Health Recommendations

Many public health organizations—including the American Diabetes Association, the American Heart Association, and the American Cancer Society—recommend legumes (the category in which soybeans are classified) as a key food group for preventing disease and optimizing health. The 2005 Dietary Guidelines for Americans developed by the U.S. Department of Health and Human Services (USDHHS) and the U.S. Department of Agriculture (USDA) recommends 3 cups of legumes per week (based on a daily intake of approximately 2,000 calories). Because 1 serving of legumes was defined as 1/2 cup cooked, the Dietary Guidelines for Americans come very close to this as they recommend of 1/2 cup of cooked legumes on a daily basis. Based on our own research review, we believe that 3 cups of legumes per week is a very reasonable goal for support of good health. However, we also believe that optimal health benefits from legumes may require consumption of legumes in greater amounts. This recommendation for greater amounts is based upon studies in which legumes have been consumed at least 4 days per week and in amounts falling into a 1-2 cup range per day. These studies suggest a higher optimal health benefit level than the 2005 Dietary Guidelines: instead of 3 cups of weekly legumes, 4-8 cups would become the goal range. Remember that any amount of legumes is going to make a helpful addition to your diet. And whatever weekly level of legumes you decide to target, we recommend inclusion of soybeans among your legume choices.

Soybeans, cooked
1.00 cup
(172.00 grams)

Calories: 298
GI: very low

Nutrient	DRI/DV
molybdenum	287%
copper	78%
manganese	71%
phosphorus	60%
protein	57%
iron	49%
omega-3 fats	43%
fiber	41%
vitamin B2	38%
magnesium	37%
vitamin K	37%
potassium	25%

Health Benefits

The Soy Controversy

Given the fact that soybeans are a food that has been enjoyed by millions of people over thousands of year, it's unexpected to find so much controversy surrounding this legume. And yet in the public press and in scientific research, soybeans have been a topic of ongoing controversy. For example, in 1999, the U.S. Food and Drug Administration (FDA) authorized a health claim for soy protein as a nutrient that could reduce risk of heart disease. And yet in 2007, numerous scientists in the U.S. officially asked the FDA to revoke its heart-related health claim for soy protein.

We suspect that one basic factor accounts for most of the controversy that has surrounded soy and its role in a healthy diet. This factor is what we would summarize as "east versus west." Soybeans were adopted as important parts of the diet in China (and then later in Japan and Korea) long before they became part of European or North American diets. Culinary traditions involving soy have existed for dozens of generations across Asia, but remain almost non-existent even today in Western countries like the United States. When research is conducted on the health benefits of soybean in Asian diets, the findings seldom match up with research findings on U.S. and European populations.

What makes Eastern countries and Western countries so different with respect to soy? The answer to this question is complicated, but three issues seem especially important.

Soybeans are typically consumed as whole foods in the East

First and perhaps foremost is the approach to soybeans as a dietary component in Eastern versus Western countries. In Eastern countries like China, Japan, and Korea, soybeans are typically consumed as whole foods. They may be cooked, roasted, fermented, or sprouted, but they are allowed to remain intact in the diet. Soybean consumption in Asia almost always involves a form of the legume that is whole food-related. In sharp contrast, consumption of soy in the United States seldom involves a whole food form. In the U.S., most of the soybean we consume has been highly processed, following cracking, dehulling, crushing, or being subjected to solvent extraction processes to separate the oils from the rest of the bean.

Total soy consumption is different when comparing East to West

The amount of total soybean consumption in Eastern versus Western countries is also very different. In studies from China and Japan, it's not surprising to see intake of soybeans occurring at the level of 100-200 grams per day. Yet in the U.S., we average less than one-tenth of that amount.

Metabolic differences

Longstanding culinary traditions involving soy also seem to have contributed in various ways to important metabolic differences in Asian versus non-Asian populations. For example, about 50-60% of adults in Japan, China and Korea digest soybeans in such a way as to convert daidzein (one of soy's key isoflavone phytonutrients) into equol (a closely-related phytonutrient called an isoflavan). By contrast, when U.S. adults eat soybeans, only 25-30% metabolize daidzein in this way. The role of bacteria in the digestive tract seems critical in the equol production process, and there may be other aspects of metabolism that also play pivotal roles.

When combined, these metabolic and whole-versus-processed food differences make research on soy difficult to interpret. A soy-related dietary practice that works for adults in China may not work for adults in the U.S., or vice-versa. In addition, until soybeans are enjoyed on a more regular basis in their whole food form in the U.S., research studies on U.S. adults may continue to show mixed results in terms of health benefits.

Even with all of the "east versus west" circumstances that complicate research on soybeans and health, we believe several areas of health benefit still shine through in studies of this much-loved legume. In the paragraphs below, you will learn more about these specific health areas.

Overall Nutrient Benefits

According to a recent research analysis, U.S. adults would increase their intake of folate, vitamin K, calcium, magnesium, iron and fiber if they replaced their meat and dairy intake with soy. Since legumes like soybeans are often overshadowed by vegetables and fruits in terms of nutrient richness, we sometimes forget just how beneficial legumes like soybeans can be.

Along with the nutrients listed above, soybeans are also an important source of the minerals copper, manganese, molybdenum, phosphorus, and potassium; the B vitamin, riboflavin; and omega-3 fatty acids (in the form of alpha-linolenic acid). Replacing meat and dairy with soy would also lower total cholesterol intake by about 125 milligrams per day and saturated fat by about 2.4 grams per day. These nutritional changes, in turn, would lower risk of several chronic diseases, including cardiovascular diseases. The idea of getting 10 grams of fiber and 25-30 grams of high-quality protein for 300 calories (1 cup of soybeans) is somewhat amazing. On a diet of 1,800 calories, 300 calories would only represent 16-17% of the total calories for one day. Yet, while only taking up one-sixth of the day's calories, a cup of soybeans provides us with 40% of the Daily Value for fiber and 50-60% of the Daily Value for protein!

In addition to all of their nutrient richness described above, soybeans also offer many unique nutrients less familiar to most people. In some cases, the health benefits of these nutrients are only beginning to be understood by researchers. Below is a list of some key nutrients currently under investigation in soybeans.

- Flavonoids and Isoflavonoids
    - daidzein
    - genistein
    - malonylgenistin
    - malonyldaidzin
- Phenolic Acids
    - Caffeic acid
    - Coumaric acid
    - Ferulic acid
    - Gallic acid
    - Sinapic acid
- Phytoalexins
    - glyceollin I
    - glyceollin II
    - glyceollin III
- Phytosterols
    - beta-sitosterol
    - beta-stigmasterol
    - campestrol
- Proteins and Peptides
    - defensins
    - glycinin
    - conglycinin
    - lunacin
- Saponins
    - soyasaponins (group A and group B)
    - soyasapogenols

Cardiovascular Benefits

As discussed earlier, research on soybeans has provided mixed results in the area of cardiovascular benefits, with some studies showing no benefits and other studies showing significant ones. We believe that two aspects of the "east versus west" phenomenon described earlier may have contributed to these mixed findings. First is the difference between studies involving whole soybeans versus studies involving processed soybean components (like soy protein isolates). In repeated research findings, whole food soybeans have been shown to provide us with better cardiovascular support than dietary supplements containing soy components. "Better" in this case means not only more consistent but also more in-depth cardiovascular support.

However, even in the case of whole food soybeans, we would not describe this cardiovascular support as being "strong." A better word would be "moderate." The most consistent effect of soybean intake on blood fats has been a moderate lowering of LDL cholesterol. Some studies show other positive impacts on blood fats, such as the lowering of triglycerides and total cholesterol or the raising of HDL cholesterol (the "good" cholesterol). However, these additional blood fat results have not been confirmed in all studies.

Soyasaponins are soy phytonutrients that have been especially interesting to researchers with respect to their cardiovascular benefits. There is some evidence, mostly in animal studies, that soyasaponins can lessen the rate of lipid peroxidation in blood vessels, lessen absorption of cholesterol from the GI tract, and increase excretion of fecal bile acids. All of these events would be expected to contribute to a decreased risk of cardiovascular disease. We look forward to further studies involving humans who take in soyasaponins through a normal diet that includes whole food soybeans.

Cancer Prevention Benefits

The area of cancer prevention is perhaps the most controversial area of health research on soybeans. Many studies provide us with evidence that supports the role of whole soy foods in a cancer-preventing diet. Genistein (an isoflavone phytonutrient in soy) is often a key focus in these cancer-prevention studies. This soy isoflavone can increase activity of a tumor suppressor protein called p53. When p53 becomes more active, it can help trigger programmed cell death (apoptosis) in cancer cells, and it also help trigger cell cycle arrest (helping stop ongoing cancer cell activity). Genistein has also been shown to block the activity of protein kinases in a way that can help slow tumor formation, especially in the case of breast and prostate cancer. It's also worth noting here that genistein becomes more concentrated in soy foods when those foods are fermented.

All of the above cancer-preventing possibilities of genistein and soy are complicated by other real-life factors, however. In some studies, the amount of genistein required to trigger cancer-preventive effects has been relatively high, and far higher than the amount provided by average intake among U.S. adults. The lifecycle and metabolic status of individuals also seems to make a potentially important difference in the anticancer benefits of soy. For example, in studies on soy intake and breast cancer, women who are pre-menopausal and develop tumors that are neither estrogen receptor nor progesterone receptor positive, soy and genistein intake do not appear to offer risk reduction. Overall dietary intake may also make an important difference in the anticancer benefits of soy. For example, without strong dietary intake of fresh fruits and vegetables, soy foods many not provide a reliable level of anticancer benefits.

In addition to the precautions about anticancer benefits of soy described above, there is also some evidence that large amounts of processed soy components (like might be obtained from large doses of purified soy isoflavones through dietary supplements) may actually increase risk of certain cancers, including breast cancer. This evidence should not be surprising. Under certain metabolic circumstances, most antioxidant, anti-inflammatory, and anti-tumor compounds can also act in a way that is pro-oxidant, pro-inflammatory, and pro-tumor (often called a "proliferative" affect that is promoting of tumor growth). It's certainly easy to see why soy has remained so controversial in the minds of some researchers!

Our recommendations to you based on all of this information are as follows: first, if you have a family history of hormone-related cancers like breast cancer or prostate cancer, we recommend that you consult with your healthcare provider before consuming very large amounts of soy in your diet (for example, 3 or more servings per day). This recommendation is a conservative one on our part, but we believe that it's justified based on the current level of controversy in the health research. Second, we recommend that you choose whole food soybeans whenever possible, rather than highly processed versions like soy protein isolates and soy protein concentrates. Finally, we recommend that you consider fermented versions of soy (including tempeh, fermented tofu, and miso) which have a better research track record in the cancer prevention area than non-fermented soy products.

In the overall picture, we continue to believe that soy foods can provide you with important health benefits, including anti-cancer benefits. But we also believe that persons wanting to include soy in an anti-cancer diet need to pay attention to the form of the soy, the amount consumed, their personal health history, and in some cases, the advice of their healthcare provider.

Soy and Hot Flashes

Hot flashes are very common symptoms of menopause and peri-menopause in U.S. women (often called "night sweats" when they occur at night) can cause great suffering and can easily affect mood throughout the day and impair concentration. Approximately 70-80% of U.S. women of menopausal and peri-menopausal age experience hot flashes, in comparison with approximately 10-20% of Asian women. By comparison, the average level of the soy isoflavone genistein in the bloodstream of Asian women is approximately 25 nanograms per milliliter, but in U.S. women, only 2 nanograms. This sharp contrast between frequency of hot flash symptoms and soy genistein levels has led many researchers to wonder about the hot flash-preventing potential of soybeans. Unfortunately, most studies to date fail to establish a reliable connection between dietary soy intake and occurrence of hot flashes. It's possible that future research studies will tell a different story, but at present, we aren't aware of any findings that show clear benefits for hot flash relief from increased intake of soy.

Bone Health Benefits

The area of bone health benefits from soy has remained nearly as controversial as the anti-cancer area due to the large amount of mixed evidence found in human studies on soy and bone health. In support of bone benefits has been the finding in many studies of improved markers of bone health following consumption of soy. (Improved bone health markers have included a decrease in the number of cross-linked telopeptides and a decrease in blood levels of bone specific alkaline phosphatase.) In addition, a lower rate of osteoporosis in some countries has been associated with increased intake of whole soy foods, especially fermented whole soybean foods. At the same time, however, soy intake (especially processed soy intake, including soy protein concentrates, isolated soy protein, and supplements containing purified soy isoflavones) has often failed to show any improvement in bone mineral density or bone metabolism.

Some of the mixed findings appear to be related to conversion of the soy isoflavone, daidzein, by intestinal bacteria into a metabolite called equol. In some Asian countries, the rate of equol formation in adults is approximately double the rate of U.S. adults. (Interestingly, among U.S. adults, the rate of equol formation from daidzein is almost double in vegetarians versus non-vegetarians.) Soy foods appear to be more helpful in supporting bone (for example, in lessening loss of minerals from bone) when individual metabolism and gut micro-organisms support the conversion of daidzein into equol. There is also some evidence that this entire process may be under some level of genetic regulation.

In the overall picture, we continue to believe that soy foods can provide you with important health benefits, including bone-related benefits. It's important to remember that soybeans provide a good amount of vitamin K—a much-needed nutrient with respect to bone health. (Soy foods fermented with *Bacillus* bacteria may be able to provide additional vitamin K benefits, as described later on in this Health Benefits section.) Equally important, soy protein is a plant protein. In broad studies of diet and bone health, plant proteins have a better track record in support of bone than animal proteins. Even though many controversies remain in the area of soybeans and bone health, we believe that your 4-8 cups of legumes each week (our World's Healthiest Foods recommended intake level for legumes) should contain some whole food form of soybeans—and especially versions that have also been fermented.

Soybeans and Obesity

Increased protein intake has always been associated with suppression of appetite, and plant foods like soy that provide concentrated amounts of protein have a research-based ability to help suppress appetite. (Of course, our experience of appetite is very complicated, and there is no simple way to change our appetite exclusively through diet.) Some studies on unique peptides (protein-like components) in soy have shown the ability of this peptides to decrease synthesis of SREBPs (sterol regulatory element binding proteins), thereby helping decrease synthesis of certain fatty acids as well as depositing of these fatty acids in fat cells. This fascinating research on soyfoods and obesity is still in the early stages, however.

Soybeans and Type 2 Diabetes

A second area of potential health benefit is prevention of type 2 diabetes. In multiple animal studies, soy foods have been shown to lessen insulin resistance by increasing the synthesis of insulin receptors. However, this increased formation of insulin receptors only appears to occur in the presence of other dietary circumstances, like a moderate amount of polyunsaturated fat intake. High levels of total soy intake (approximately 200 grams per day) have also been associated with decreased risk of type 2 diabetes, but only in Asian populations thus far. We look forward to more research on human consumption of soy and prevention of chronic health problems related to insulin metabolism and blood sugar levels.

Soybeans and Vitamin K

Soybeans of all kinds qualify as a good source of vitamin K based on our food-nutrient ranking system. However, your vitamin K benefits from soybeans may be increased in the case of certain fermented soy foods. By far the most famous micro-organism used in fermentation of soybeans is the koji mold, *Aspergillus oryzae*. (*Aspergillus oryzae* can also be called a fungus, since molds are simply a special type of fungus called filamentous fungus.) Koji mold is a key to many of the unique qualities of many soy pastes, as well as soy miso and soy sauce. However, other micro-organisms may also be used to help ferment soybeans, and one is the bacterium *Bacillus subtilis*. The use of *Bacillus subtilis* in soybean fermentation is especially important in production of the fermented soy food, natto (and (*Bacillus subtilis var. natto* is one special variant (strain) of *Bacillus* used in natto production.) Natto is a sticky and stringy form of soybeans in which you can still see the individual beans. It has a distinctly pungent aroma, and it has been widely enjoyed in Asia cuisines for several thousand years, and especially in Japanese cuisine. However, *Bacillus* bacteria are also sometimes used in the production of other fermented soy foods, including soy pastes (especially Chinese soy pastes) and soy miso. Korean-style soy sauce may also be fermented with the help of *Bacillus* bacteria.

From a health standpoint, one of the reasons that *Bacillus* bacteria are so interesting is their ability to create a form of vitamin K called menaquinone-7 (MK-7). Vitamin K (in all forms) is an important nutrient for bone health. Sufficient intake of vitamin K is associated with decreased risk of osteoporosis, since this vitamin is involved with maintenance of bone mineral density and also with shaping of bone structure (through gamma-carboxylation). In the case of MK-7 (the form of vitamin K produced by *Bacillus* bacteria, and a member of the vitamin K2 menaquinone family), we know that higher levels of MK-7 in the blood correspond to lower risk of hip fracture in older Japanese women, and that higher MK-7 levels correspond to increased intake of soy foods that have been fermented with *Bacillus* bacteria. One fascinating aspect of *Bacillus*-fermented soy foods is the potential ability of these bacteria to stay alive in our lower intestine after these foods are consumed. We've seen one study in which 1.6-20 million *Bacillus* bacteria (per gram of feces) were found to remain alive up to 6 days following consumption of natto. If *Bacillus* bacteria from fermented soy foods can remain alive in our digestive tract, they may keep providing us with vitamin K benefits many days after their consumption.

Another interesting piece of information about vitamin K and fermented soy foods involves regulation of health claims on food products in Japan. The Foods for Specified Health Uses, or FOSHU system does not currently allow for bone-related health claims for natto in the Japanese marketplace, even though this food is an approved FOSHU product recognized as containing

MK-7. The reason for disallowed health claims is the lack of vitamin K deficiency in Japan, not lack of data to support a possible MK-7 benefit. (In other words, the Japanese population may already be taking good advantage of fermented soy foods and their potential vitamin K benefits!)

Other Areas of Potential Health Benefit

Other areas of active research on soy and health include chronic obstructive pulmonary disease (COPD), periodontal disease, and neurodegenerative disease.

Description

While not the most widely cultivated of all beans (that distinction goes to *Phaseolus vulgaris*, also know as the "common bean"), soybeans are a traditional part of diets in China, Japan and Korea and are currently grown in countries across the world including Brazil, Argentina, India, Paraguay, Canada, and the United States. At present, the United States plants and produces more soybeans than any other country in the world—approximately 83 million metric tons grown on 75 million acres of land. However, nearly 99% of all soybeans grown in the U.S. are processed for production of soil meal (to be used in animal feed) and soy oil. In countries where soybeans are consumed in whole food form rather than undergoing processing into meal and oil, these legumes often serve as an important and relatively inexpensive source of protein.

Like their fellow legumes, soybeans are actually seeds of a plant. In the case of soybeans, the plant is *Glycine max*. (The soybeans we find in the grocery store have already been removed from the pod and dried out.) We're accustomed to seeing dried soybeans in their light tan or pale yellow color, but mature dried soybeans can actually be found in a variety of different colors including black, brown, and blue. Fresh (undried) soybeans, however, are always green in color and when carefully cooked—either in the pod or after being removed from the pod—can turn an even richer and brighter shade of green. Although you will find some websites referring to green soybeans as "immature soybeans," that term isn't always accurate. Soybeans *could* be harvest at an immature stage, but many green soybeans available for purchase in the grocery store are mature when harvested—just not dried. Edamame (which means "stalk beans" or "branch beans" in Japanese) is a term that you will often see used to describe fresh green soybeans that may be available either individually or still inside the pod and may either be raw or already boiled or steamed. In all cases, the major difference is that edamame have not been dried. It's worth noting that in recent research studies, edamame have been shown to contain a similar level of isoflavonoids as cooked soybeans that were prepared from dry form.

Other whole food forms of soy include full fat soy milk, tofu, natto, and miso. Processed forms of soy such soybean oil, defatted soy flour and soy protein concentrates such as TVP (texturized soy protein and SPI (soy protein isolate) abound. We always recommend whole food forms of soy (for more detail on these different forms of soy see WHFoods Recommendations above).

History

Soybeans have been cultivated in China for thousands of years, and they also became popular in other Asian countries (especially Japan and Korea) over a thousand years ago (as early as the third and fourth centuries AD). Thanks to their origins in Asia, we continue to use three Japanese words - "tofu" (itself from the Chinese word "doufu"), "natto," and "edamame" (meaning "branch bean" or "stalk bean") to refer to various forms of this wonderful legume.

Many countries in the world depend on soybeans and other legumes as key sources of dietary protein. However, for the past 30-35 years, soybeans have seldom been produced in the United States for the purpose of being consumed in whole food form by humans. Instead, a $20 billion industry has grown up around the cultivation of soybeans as an "oilseed" crop that can be traded alongside of other interchangeable commodities like rapeseed, sunflowerseed, and cottonseed. Even though the United States has become the world's larger grower of soybeans (producing approximately 83 million metric tons of soybeans on 75 million acres of land), these soybeans are not being cultivated for human food use but for other purposes (their extractable oil and their processing into animal feed). This historical trend has given rise to a whole new classification of soybeans as an "oilseed crop" or "oilseed commodity." When economists talk about soybeans that are intended to be consumed in whole food form by humans, they use the terms "vegetable soybeans" or "garden soybeans" or "edible soybeans" to describe this food.

This new interest in soybeans as an oilseed crop has also been accompanied by widespread genetic engineering of the legume. Nearly 90% of all soy products in the U.S. marketplace now come from soybeans that have been genetically engineered (GE), making them one of the world's top foods in terms of genetic modification. Genetic engineering of soybeans began as early as 1998 with the introduction of soybeans into the marketplace that had been modified for better resistance to the commercial herbicide glufosinate ammonium. Since 1998, at least eight other GE patents have been granted for use on soybeans, most of them involving better resistance to pesticides and herbicides. If you are trying to avoid consumption of GE soy in your diet, your best bet is to purchase certified organic soybeans and soy products, since genetic engineering is not allowed under federal organic regulations.

How to Select and Store

Dried soybeans are generally available in prepackaged containers as well as bulk bins. Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the soybeans are covered and that the store has a good product turnover so as to ensure its maximal freshness. Whether purchasing soybeans in bulk or in a packaged container, make sure that there is no evidence of moisture or insect damage, and that the beans are whole and not cracked.

Canned soybeans (dried beans that have been cooked for you by the manufacturer) can be found in many markets. Unlike canned vegetables, which can lose much of their nutritional value, there is typically less loss of nutrient richness with the canning of soybeans. Canning lowers vegetables' nutritional value since they are best lightly cooked for a short period of time, while their canning process often requires a longer cooking time and/or higher cooking temperatures. By contrast, dried beans require a longer cooking time whether they are cooked by the manufacturer and then canned for your convenience, or whether you purchase them in dry form and cook at home yourself. Therefore, if enjoying canned beans is more convenient for you, by all means go ahead and enjoy them. We would suggest looking for those that do not contain extra salt or additives. (One concern about canned foods is the potential for the can to include a liner made from bisphenol A (BPA). To learn more about reducing your exposure to this compound, please read our write-up on the subject).

Of course, another alternative for soybeans is to purchase them in their fresh green form before they have been dried. Edamame (fresh green soybeans that may be raw or may already have been boiled or steamed either individually or in the pod) should be deep green in color and if purchased in the pod should come from pods that are firm and unbruised. Edamame can be found in many supermarkets as well as in natural foods stores and Asian markets. It is usually available in the frozen food section, although during its peak season you can find it the produce aisle of many natural food stores and Asian markets.

Remember to stick with the whole food forms of soy, and also consider giving preference to fermented versions like tempeh, fermented tofu, and soy miso.

Store dried soybeans in an airtight container in a cool, dry and dark place where they will keep for up to 12 months. If you purchase soybeans at different times, store them separately since they may feature varying stages of dryness and therefore will require different cooking times. Cooked soybeans will keep fresh in the refrigerator for about three days if placed in a covered container.

Fresh edamame should be stored in the refrigerator and eaten within two days. Frozen edamame will keep fresh for a few months.

How to Enjoy

A Few Quick Serving Ideas

- Replace some of the wheat flour in your favorite baked goods recipe with soybean flour and increase the protein content of your cookies, cakes, muffins and breads.
- Mix sprouted soybeans into salads or use as toppings for sandwiches.
- Frozen edamame is simple to prepare and makes a great snack or appetizer. Just add the soybean pods to slightly salted water and boil for approximately 10 minutes.
- Add soybeans to vegetable stews and soups.

WHFoods Recipes That Feature Soybeans

Soybean and Fennel Salad

Safety

Soybeans and Food Allergies

Soybeans are among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions

Soy Food and Thyroid Health

Along with the increasing presence of soy foods in grocery stores and on restaurant menus has come increasing controversy over soybeans and thyroid health. We're not surprised to find strong conflicting opinions in this area because scientific research on thyroid and soy is both complicated and inconclusive. We have written an extensive review of what we know—and what we don't know—about this important issue at this point. You find the article Soy Food and Thyroid Health here.

Genetically Modified Soybeans

Conventionally grown soybeans is one of the foods that is often grown from genetically modified seeds. For helpful information about genetically modified foods—including our WHFoods Recommendations—please see our article, What Is Your Approach to Genetically Modified Foods?

Soybeans and Phytates

Phytates are substances found in soybeans (and many other foods) that can lessen the absorption of certain nutrients, especially minerals. Soy products in general (including products that are minimally processed) contain 1.4-3.0% phytates. Soy isolates (commonly used production of low-fat soy milk) usually contain a minimum of 2.89% phytates, and soy concentrates can contain up to 4.8-4.9% phytates. The message here seems clear: you're likely to get better nourishment from soy (especially mineral nourishment) if you consume it in whole food versus processed form.

Other Controversies

Some animal foods and some plants foods have been the subject of ongoing controversy that extends well beyond the scope of food, nutrient-richness, and personal health. This controversy often involves environmental issues, or issues related to the natural lifestyle of animals or to the native habitat for plants. Soybeans has been a topic of ongoing controversy in this regard. Our Controversial Foods Q & A will provide you with more detailed information about these issues.

Other Questions about Soybeans

If you are looking to learn more about other questions related to soybeans, the following articles may be of interest:

- Can you tell me more about the goitrogens, soybean agglutinin (SBA), and phytates found in soy products?
- Is it true that the traditional methods of preparing and consuming soy are greatly disregarded today?
- I have heard that most of the soy products now on the market are far removed from the whole soybean from which they are made. How does this affect their nutritional value?
- Is it true that most soy crops are now genetically engineered?

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Soybeans, cooked
1.00 cup
172.00 grams

Calories: 298
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
molybdenum	129.00 mcg	287	17.3	excellent

copper	0.70 mg	78	4.7	excellent
manganese	1.42 mg	71	4.3	very good
phosphorus	421.40 mg	60	3.6	very good
protein	28.62 g	57	3.5	very good
iron	8.84 mg	49	3.0	good
omega-3 fats	1.03 g	43	2.6	good
fiber	10.32 g	41	2.5	good
vitamin B2	0.49 mg	38	2.3	good
magnesium	147.92 mg	37	2.2	good
vitamin K	33.02 mcg	37	2.2	good
potassium	885.80 mg	25	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Tempeh

What's New and Beneficial About Tempeh

- A recent study from Kuala Lumpur, Malaysia has provided us with some fascinating results about the bioavailability of calcium from tempeh. In this study involving postmenopausal women, calcium from tempeh was determined to be as equally well absorbed as calcium from cow's milk. Due to the higher concentrations of calcium in cow's milk versus tempeh, however, four servings of tempeh were needed to bring the total amount of calcium absorbed from tempeh up to the same level as the total amount of calcium absorbed from fresh cow's milk. Still, the excellent bioavailability of calcium from tempeh was am important research finding in this study, since many women (as well as men) would benefit from increased intake of calcium from non-dairy foods, and tempeh clearly performed very well as a calcium source in this study.

Tempeh is a food made from soybeans. While not as popular in the United States as tofu, it is still a great example of how a simple food like soybeans can be woven into human food traditions in a way that is natural, inexpensive, and nourishing.

Tempeh, cooked
4.00 oz
(113.40 grams)

Calories: 222
GI: very low

Nutrient	DRI/DV
manganese	73%
copper	68%
fiber	48%
protein	41%
phosphorus	41%
vitamin B2	31%
magnesium	22%

Health Benefits

In the Health Benefits section of our Soybeansfood profile, we provide an in-depth look at many of the controversial issues surrounding soy foods and their role in health. (You may want to visit that section of our website to learn more about these issues.) One of the most important things to remember about tempeh is their basic whole food nature. The vast majority of soy consumed in the U.S. comes from a highly processed form of soy. The soybeans we consume have usually been genetically engineered, cracked, dehulled, crushed, and subjected to solvent extraction to separate their oils from the rest of the bean. What's left behind after oil extraction (defatted soy flour) is then further processed into animal feed, or processed to produce a protein concentrate or a protein isolate. The isolate can be used as an ingredient in low-fat soymilk, and the concentrate can be further processed (extruded) to form a textured soy protein for use in meat analog products (like soy burgers). Tempeh is produced with significantly less processing than most low-fat soymilks and soy burgers, and they are soy foods that are much closer to a "whole foods" category than soy protein isolates and concentrates.

While there is existing research that indicates the possibility of certain health risks from consumption of soy, we believe that a significant amount of these possible health risks involve consumption of soy in a highly processed form (like soy protein isolate or soy protein concentrate) rather than a whole food form. By contrast, we view tempeh as a form of soy that is closer to soy in its whole food form.

From a health benefits standpoint, we also like the fermented nature of tempeh. Fermentation increases the digestibility of soy (especially its proteins), nutrient absorption from soy (including absorption of phytonutrient isoflavones like genistein and daidzein), and the concentration of bioactive peptides (formed during the breakdown of soy proteins during fermentation).

Overall Nutrient Benefits

According to a recent research analysis of the U.S. population and dietary practices within this population, U.S. adults would increase their intake of folate, vitamin K, calcium, magnesium, iron and fiber if we replaced our meat and dairy intake with soy, including tempeh. Replacing meat and dairy with tempeh and other soy products would also lower our total cholesterol intake by about 125 milligrams per day and our saturated fat by about 2.4 grams per day. These nutritional changes, in turn, would lower our risk of several chronic diseases, including cardiovascular diseases.

Soy foods typically contain a wide variety of well-studied phytonutrients. In the case of fermented soy foods like tempeh these phytonutrients can become more concentrated and more bioavailable as well. Below is a list of some key phytonutrients that can be found in tempeh and other soy foods.

- Flavonoids and Isoflavonoids
    - daidzen
    - genistein
    - malonylgenistin
    - malonyldaidzin
- Phenolic Acids
    - Caffeic acid
    - Coumaric acid
    - Ferulic acid
    - Gallic acid
    - Sinapic acid
- Phytoalexins
    - glyceollin I
    - glyceollin II
    - glyceollin III
- Phytosterols
    - beta-sitosterol
    - beta-stigmasterol
    - campestrol
- Proteins and Peptides
    - defensins
    - glycinin
    - conglycinin
    - lunacin
- Saponins
    - soyasaponins (group A and group B)
    - soyasapogenols

Before concluding this phytonutrient section, we think it's important to point out one nutrient-related aspect of soy processing. Phytates are substances found in soybeans (and many other foods) that can lessen the absorption of certain nutrients, especially minerals. Soy products in general (including products that are minimally processed) contain 1.4-3.0% phytates. Soy isolates (commonly used production of low-fat soy milk) usually contain a minimum of 2.89% phytates, and soy concentrates can contain up to 4.8-4.9% phytates. Forms of soy that are more whole food-based like tempeh will do a better job of lowering your phytate exposure than highly processed forms of soy like soy protein concentrates or isolates.

Cardiovascular Benefits of Tempeh

We've seen very few studies of soy and cardiovascular health that are specific to tempeh. However, we do know that whole food soy products provide better cardiovascular support than dietary supplements containing isolated soy components (like purified isoflavones). We also know that fermented soy foods like tempeh have more bioactive peptides than non-fermented soy foods. (Peptides are smaller breakdown parts of proteins.) In the case of fermented soy foods, two key storage proteins—glycinin and conglycinin—are broken down by molds, yeasts, and bacteria into peptide fragments that have antioxidant, anti-inflammatory, and blood pressure-lowering properties. For example, some of the peptides found in tempeh inhibit angiotensin-converting-enzyme (ACE) and are therefore classified as "ACE inhibitors." When this enzyme is inhibited, it is often easier for the cardiovascular system to regulate blood pressure. The antioxidant and anti-inflammatory properties of soy peptides found in fermented soy foods can help protect the blood vessels from oxidative and inflammatory damage.

Intake of soy foods (especially whole soy foods) has been associated with improved levels of blood fats in numerous research studies. However, even in the case of whole soy foods, we would not describe this improvement of blood fat levels as being "strong." A better word would be "moderate." The most consistent effect of soybean intake on blood fats has been a moderate lowering of LDL cholesterol. Some studies show other positive impacts on blood fats, like the lowering of triglycerides and total cholesterol or the raising of HDL cholesterol (the "good" cholesterol). However, these additional blood fat results have not been confirmed in all studies.

Soyasaponins are soy phytonutrients that have been especially interesting to researchers with respect to their cardiovascular benefits. There is some evidence, mostly in animal studies, that soyasaponins can lessen the rate of lipid peroxidation in blood vessels, lessen absorption of cholesterol from the GI tract, and increase excretion of fecal bile acids. All of these events would be expected to contribute to a decreased risk of cardiovascular disease. Soyasaponins are provided in many forms of soy, but fermentation of soy has been shown to increase their concentration. Increased levels of soyasaponins in fermented soy foods like tempeh are likely to play a role in the better track record of fermented (versus non-fermented) soy foods in the area of cardiovascular benefits.

Cancer Prevention Benefits

The area of cancer prevention is a controversial area of health research on soybeans. Many studies provide us with evidence that supports the role of whole soy foods in a cancer-preventing diet. Genistein (an isoflavone phytonutrient in soy) is often a key focus in these cancer-prevention studies. This soy isoflavone can increase activity of a tumor suppressor protein called p53. When p53 becomes more active, it can help trigger programmed cell death (apoptosis) in cancer cells, and it also help trigger cell cycle arrest (helping stop ongoing cancer cell activity). Genistein has also been shown to block the activity of protein kinases in a way that can help slow tumor formation, especially in the case of breast and prostate cancer. Importantly, genistein is found in higher concentrations in fermented soy foods like tempeh (compared to non-fermented soy foods like soymilk, isolate soy protein, concentrated soy protein, textured soy protein—also known as TVP—and non-fermented tofu).

Even in the case of fermented soy foods and their higher concentration of isoflavones like genistein, however, the potential cancer-related benefits of soy are complicated by other real-life factors. For example, the lifecycle and metabolic status of an individual seems to make a potentially important difference in the anticancer benefits of soy (even fermented soy). In studies on soy intake and breast cancer involving women who are pre-menopausal and develop tumors that are neither estrogen receptor positive nor progesterone receptor positive, soy and genistein intake (even from fermented soy foods) does not appear to offer risk reduction. Overall dietary intake may also make an important difference in the anticancer benefits of soy. For example, without strong dietary intake of fresh fruits and vegetables, even fermented soy foods may not provide reliable anticancer benefits.

In several studies, large doses of purified soy isoflavones (obtained through dietary supplements) has been associated with increased risk of certain cancers, including breast cancer. This evidence should not be surprising. Under certain metabolic circumstances, most antioxidant, anti-inflammatory, and anti-tumor compounds can also act in a way that is pro-oxidant, pro-inflammatory, and pro-tumor (often called a "proliferative" effect that is promoting of tumor growth). We view intake of tempeh as very different from intake of highly processed forms of soy, or intake of dietary supplements containing purified soy components. And our recommendations to you based on all of this information is as follows:

First, if you have a family history of hormone-related cancers like breast cancer or prostate cancer, we recommend that you consult with your healthcare provider before consuming very large amounts of soy in your diet (for example, 3 or more servings per day). And while this recommendation is a conservative one on our part, we believe that it's justified based on the current level of controversy in the health research on soy.

Second, we recommend that you choose whole food soybeans whenever possible, rather than highly processed versions like soy protein isolates and soy protein concentrates. Especially good choices in this context would be whole food-type soy products that have also been fermented, like tempeh (or fermented tofu). In general, it's worth remembering that fermented soy foods have a better track record in cancer prevention than non-fermented soy products.

Fermented Soy Foods and Vitamin K

Fermentation of soy foods can often result in increased formation of vitamin K, especially when bacteria called *Bacillus subtilis* participate in the fermentation process. When Bacillus bacteria are used to help ferment tempeh, they are able to create a form of vitamin K2 called menaquinone-7 (MK-7). Studies have shown that higher levels of MK-7 in the blood correspond to lower risk of hip fracture in older Japanese women, and that higher MK-7 also correspond to increased intake of soy foods fermented with Bacillus bacteria.

Unfortunately, however, we have not found nationally marketed tempeh in the U.S. that appears to have been fermented with the help of *Bacillus* bacteria as reflected in significant vitamin K content. Nutrient databases that are widely used in the U.S. to document the nutritional content of food usually report tempeh as providing no measurable amount of vitamin K in a standard serving, and since we make use of those nutrient databases in our own ranking system, we also show no measurable vitamin K in our nutrient profile for tempeh. It may be possible for you to find some tempeh products that have been traditionally fermented and that have been fermented with the help of *Bacillus* bacteria. If you are able to find these products, they may be able to make a valuable contribution to your vitamin K intake. However, as a general rule, it's best to assume that the tempeh you purchase at the grocery store will not be able to provide you with vitamin K.

Other Areas of Potential Health Benefit

There are several other areas of potential health benefit from tempeh that we believe deserve special mention. First is prevention and treatment of obesity. In this context, it is some of the unique peptides (protein breakdown products) in soy that have been associated with obesity prevention and treatment. Some of these peptides have shown the ability to decrease synthesis of SREBPs (sterol regulatory element binding proteins), thereby helping decrease synthesis of certain fatty acids as well as the depositing of these fatty acids in fat cells. Since fermented soy foods like tempeh have increased concentrations of bioactive peptides (versus non-fermented soy foods), tempeh may turn out to be premier forms of soy with respect to obesity management. However, it's important to remember that this fascinating research on soy and obesity is still in a very early stage.

A second area of potential health benefit is prevention of type 2 diabetes. In multiple animal studies, soy foods have been shown to lessen insulin resistance by increasing the synthesis of insulin receptors. However, this increased formation of insulin receptors only appears to occur in the presence of other dietary circumstances, like a moderate amount of polyunsaturated fat intake. High levels of total soy intake (approximately 200 grams per day) have also been associated with decreased risk of type 2 diabetes, but only in Asian populations thus far. We have yet to see specific studies on tempeh in this regard, but we look forward to more research in this area.

Other areas of active research on soy and health include chronic obstructive pulmonary disease (COPD), periodontal disease, and neurodegenerative disease. While we have yet to see studies on tempeh in these areas, we expect to learn more about potential benefits of tempeh in these areas.

Description

Tempeh is fermented soy food that originated on the island of Java in Indonesia and is fermented with the mold *Rhizopus oligosporus*. Fermentation of tempeh can involve a period of several days or longer, and fermentation is usually carried out at temperatures of 85-90°F/29-32°C. Tempeh is usually purchased in a cake-like form and can be sliced in a way that is similar to tofu. However, tempeh usually has a less watery texture than tofu, and in comparison to non-fermented tofu, a more distinct flavor as well. Steaming, baking, and frying are all popular ways of preparing tempeh in many countries. Tempeh is also commonly incorporated into stews, soups, and grilled kebabs.

To understand more about tempeh's health benefits, it can be helpful to think not only about fermentation of soybeans into tempeh, but about fermentation of foods in general.

Fermentation of Soy and Other Foods

Fermentation of food typically involves the breakdown of a food's carbohydrates into gasses, alcohols, and other molecules by micro-organisms. These micro-organisms include molds, yeasts, and bacteria. Common examples of fermented food include beer and wine, cider, leavened bread, yogurt, and sauerkraut. Interestingly, a relatively small number of micro-organisms account for a very large percent of commercially fermented foods, and an even smaller number account for most fermented soy foods. Fermented soy foods (including tempeh and fermented tofu) usually involve the activity of the molds *Aspergillus*, *Rhizopus*, *Mucor*, *Actinomucor* and *Neurospora*; several species of the yeast *Saccharomycces*; and numerous species of the bacteria *Bacillus* and *Pediococcus*.

While fermentation is usually defined in terms of the action of micro-organisms on a food's carbohydrates, many nutrients in food can be transformed during the process of fermentation. These nutrients can include the food's proteins, fats. vitamins, minerals, and phytonutrients. In fermented soy foods, for example, proteins are often made more digestible through fermentation. Minerals like calcium in soy foods can become more soluble and bioavailable through fermentation as can the bioavailability of many phytonutrients, including isoflavones like genistein and daidzein. In some cases, when fermentation changes the digestibility of protein in soy foods (and in other foods as well), smaller protein fragments are created (called peptides) that have unique health supportive properties of their own. For example, one of the important storage proteins in soybeans is called conglycinin. Conglycinin and its fellow storage protein, glycinin, account for as much as 80% of the total proteins in soybeans. During the process of fermentation, conglycinin in soy is often broken down into smaller peptides that serve as antioxidants, boost immune function, and prevent excessive inflammatory response.

We believe that these whole food-based forms of soy stand in clear distinction to highly processed versions of soy like soy protein concentrate or soy protein isolate.At the same time, we also believe that the research support for the health benefits of soy foods is even stronger for fermented versus non-fermented soy foods. So we also encourage you to consider inclusion of fermented soy foods among your whole soy choices. One great option here is tempeh.

History

Tempeh is one of the few soy foods not originating in China, Japan, or Korea. Instead, tempeh is believed to have first been prepared on the island of Java in Indonesia, at least hundreds of years ago. However, less is known about the exact origins of tempeh than other soy foods. We do know that trade between Indonesia and China was well underway as early as 1000 AD and that soybeans may have been a part of those trading practices. We also know that a fermentation process used for coconut was already being practiced in China and that this process may have been adapted for use with soybeans. Whatever the exact origins of tempeh, it would not have been uncommon for individuals in Java, China, Japan, or Korea to think about food preparation in terms of fermentation. Fermented foods had become a well-established part of Asian cuisines for several thousand years, and it's probably most sensible to think about tempeh as a logical part of this fermented food tradition.

One resource that we encourage you to consider if you are interested in learning more about the history of soy foods, including tempeh, is the SOYINFOCENTER. This website provides several thousand pages on soy food history (and especially the history of fermented soy foods) along with research references.

How to Select and Store

For many years it was only possible to find tempeh in natural foods and Asian stores. Yet, with the growing demand for soy foods, tempeh is now becoming more and more available in supermarkets throughout the country. Depending upon the store, tempeh may either be kept in the refrigerated or freezer section.

In a well-stocked natural foods supermarket, you'll find tempeh in a variety of forms. Some of these forms are pre-cooked and ready-to eat, indicating so on the package. Other forms are not yet cooked and should be cooked before eating. You'll find plain soy tempeh that has been made from soy and Rhizopus mold but without the addition of any grains, and you will also find tempeh made from soy-grain combinations, especially soy-rice. The tempeh you find in the supermarket may also have been flavored with soy sauce or other seasonings.

Look for tempeh that is covered with a thin whitish bloom. While it may have a few black or grayish spots, it should have no evidence of pink, yellow, or blue coloration as this indicates that it has become overly fermented. In general, choose tempeh in which the soybeans and grains appear tightly bound. Also choose tempeh that tends to have a drier outside surface. High-quality, plain soy tempeh often has an aroma that would best be described as mushroom-like.

Uncooked, refrigerated tempeh can keep in the refrigerator for up to ten days. If you do not prepare the whole package of uncooked tempeh at one time, wrap it well and place it back in the refrigerator. Uncooked tempeh will also keep fresh for several months in the freezer. If you freeze tempeh and then unthaw it, you can keep the thawed tempeh in your refrigerator for about 10 days. Also, if you are purchasing tempeh from a refrigerated display in the supermarket, check the package for a "sell by" date. It should have one, and you should make sure that it's up ahead in the calendar.

How to Enjoy

A Few Quick Serving Ideas for Tempeh

- For a twist on the traditional reuben sandwich, place broiled tempeh on a slice of whole grain bread, layer with sauerkraut, top with cheese or non-dairy "cheese" and then broil in oven for a few minutes until the sandwich is hot and toasty. Top with Russian dressing made by combining ketchup and mayonnaise, and enjoy.
- A vegetarian option to spaghetti and meat sauce is spaghetti and tempeh sauce. Just substitute tempeh for ground beef in your favorite recipe.
- Add extra flavor, texture and nutrition to chili by adding some tempeh.

Safety

Tempeh and Food Allergies

Soybeans and the foods made from them, including tempeh, are among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions

Tempeh and Thyroid Health

Along with the increasing presence of soy foods (such as tempeh) in grocery stores and on restaurant menus has come increasing controversy over soybeans and thyroid health. We're not surprised to find strong conflicting opinions in this area because scientific research on thyroid and soy is both complicated and inconclusive. We have written an extensive review of what we know—and what we don't know—about this important issue at this point. You find the article Soy Food and Thyroid Health here;

Genetically Modified Soybeans

Conventionally grown soybeans—from which tempeh is made—is one of the foods that is often grown from genetically modified seeds. For helpful information about genetically modified foods—including our WHFoods Recommendations—please see our article, What Is Your Approach to Genetically Modified Foods?

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Tempeh, cooked
4.00 oz
113.40 grams

Calories: 222
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
manganese	1.46 mg	73	5.9	very good
copper	0.61 mg	68	5.5	very good
fiber	12.00 g	48	3.9	very good
protein	20.63 g	41	3.3	good
phosphorus	286.90 mg	41	3.3	good
vitamin B2	0.40 mg	31	2.5	good
magnesium	87.32 mg	22	1.8	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Tofu

What's New and Beneficial About Tofu

- Even though soy foods in general are associated with decreased risk of cancer in several countries, a comprehensive analysis of 28 previously published studies on Chinese adults has now shown that intake of soy foods in the form of tofu (and soy miso) does a better job of reducing risk of at least one cancer type (stomach cancer) than intake than soy in general. A team of researchers at the School of Radiation Medicine and Public Health at Soochow University in Suzhou, Jiangsu Province, China arrived at this conclusion after statistical analysis of numerous studies conducted between 1998-2008. While we cannot be sure about the ability of tofu and soy miso to provide health benefits for U.S. adults in the same way that they provide health benefits for Chinese adults, we can be sure that there is something unique about tofu and miso among all varieties of soy foods, and that this uniqueness may extend to stomach cancer prevention under certain circumstances.
- In the case of fermented tofu, we've recently learned that antioxidant and free radical-scavenging health benefits are directly related to the length of fermentation time. Tofus fermented for nine versus three days have recently been shown to provide up to double the free radical-scavenging activity. We suspect that there is no magic number with respect to fermentation time, and that a variety of factors were responsible for the increased free radical-scavenging activity of these tofus after nine days of fermentation. Nevertheless, this study underscores the potentially beneficial nutrient changes that can take place when a food is carefully fermented and when micro-organisms used in fermentation are provided with enough time to grow and transform the food's nutrient potential. In this particular study a variety of micro-organisms (fungi) were used to ferment the tofu, including *Aspergillus oryzae*, *Aspergillus sojae*, *Aspergillus awamori*, *Actinomucor taiwanensis*, and *Rhizopus oligosporus*.

Tofu is a widely-enjoyed food made from soybeans, and it is a great example of how a simple food like soybeans can be woven into human food traditions in a way that is natural, inexpensive, and nourishing. Tofu is a surprisingly versatile form of soybeans that is made by curdling soymilk so that its proteins become coagulated and then pressed into a sliceable cake. Even though very little tofu sold in the U.S. has been fermented, it is also possible for tofu to be made not only through coagulation, but also through fermentation—i.e., through the addition of micro-organisms which can interact with the soy curds. (There are many health advantages to the fermentation of soy foods, and these advantages will be described in more detail throughout this food profile.)

Tofu, firm
4.00 oz
(113.40 grams)

Calories: 164
GI: very low

Nutrient	DRI/DV
calcium	77%
manganese	67%
copper	48%
selenium	36%
protein	36%
phosphorus	31%
omega-3 fats	28%
iron	17%
magnesium	16%
zinc	16%
vitamin B1	15%

Health Benefits

In the Health Benefits section of our Soybeansfood profile, we provide an in-depth look at many of the controversial issues surrounding soy foods and their role in health. (You may want to visit that section of our website to learn more about these issues.) One of the most important things to remember about tofu is its basic whole food nature. The vast majority of soy consumed in the U.S. comes from a highly processed form of soy. The soybeans we consume have usually been genetically engineered, cracked, dehulled, crushed, and subjected to solvent extraction to separate their oils from the rest of the bean. What's left behind after oil extraction (defatted soy flour) is then further processed into animal feed, or processed to produce a protein concentrate or a protein isolate. The isolate can be used as an ingredient in low-fat soymilk, and the concentrate can be further processed (extruded) to form a textured soy protein for use in meat analog products (like soy burgers). Tofu is produced with significantly less processing than most low-fat soymilks and soy burgers, it is a soy food that is much closer to a "whole foods" category than soy protein isolates and concentrates.

While there is existing research that indicates the possibility of certain health risks from consumption of soy, we believe that a significant amount of these possible health risks involve consumption of soy in a highly processed form (like soy protein isolate or soy protein concentrate) rather than a whole food form. By contrast, we view tofu as a form of soy that is closer to soy in its whole food form.

From a health benefits standpoint, there are also benefits to tofu that has been fermented. Fermentation increases the digestibility of soy (especially its proteins), nutrient absorption from soy (including absorption of phytonutrient isoflavones like genistein and daidzein), and the concentration of bioactive peptides (formed during the breakdown of soy proteins during fermentation).

Overall Nutrient Benefits

According to a recent research analysis of the U.S. population and dietary practices within this population, U.S. adults would increase their intake of folate, vitamin K, calcium, magnesium, iron and fiber if we replaced our meat and dairy intake with soy, including tofu. Replacing meat and dairy with tofu and other soy products would also lower our total cholesterol intake by about 125 milligrams per day and our saturated fat by about 2.4 grams per day. These nutritional changes, in turn, would lower our risk of several chronic diseases, including cardiovascular diseases.

Soy foods typically contain a wide variety of well-studied phytonutrients. In the case of fermented soy foods like tofu that has been fermented these phytonutrients can become more concentrated and more bioavailable as well. Below is a list of some key phytonutrients that can be found in tofu and other soy foods.

- Flavonoids and Isoflavonoids
  - daidzen
  - genistein
  - malonylgenistin
  - malonyldaidzin
- Phenolic Acids
  - Caffeic acid
  - Coumaric acid
  - Ferulic acid
  - Gallic acid
  - Sinapic acid
- Phytoalexins
  - glyceollin I
  - glyceollin II
  - glyceollin III
- Phytosterols
  - beta-sitosterol
  - beta-stigmasterol
  - campestrol
- Proteins and Peptides
  - defensins
  - glycinin
  - conglycinin
  - lunacin
- Saponins
  - soyasaponins (group A and group B)
  - soyasapogenols

  Before concluding this phytonutrient section, we think it's important to point out one nutrient-related aspect of soy processing. Phytates are substances found in soybeans (and many other foods) that can lessen the absorption of certain nutrients, especially minerals. Soy products in general (including products that are minimally processed) contain 1.4-3.0% phytates. Soy isolates (commonly used production of low-fat soy milk) usually contain a minimum of 2.89% phytates, and soy concentrates can contain up to 4.8-4.9% phytates. Forms of soy, like tofu, that are more whole food-based will do a better job of lowering your phytate exposure than highly processed forms of soy like soy protein concentrates or isolates.

Cardiovascular Benefits of Tofu

We've seen very few studies of soy and cardiovascular health that are specific to tofu. However, we do know that whole food soy products provide better cardiovascular support than dietary supplements containing isolated soy components (like purified isoflavones). We also know that fermented soy foods like fermented tofu have more bioactive peptides than non-fermented soy foods, including "regular" tofu. (Peptides are smaller breakdown parts of proteins.) In the case of fermented soy foods like tofu,, two key storage proteins—glycinin and conglycinin—are broken down by molds, yeasts, and bacteria into peptide fragments that have antioxidant, anti-inflammatory, and blood pressure-lowering properties. For example, some of the peptides found in fermented tofu inhibit angiotensin-converting-enzyme (ACE) and are therefore classified as "ACE inhibitors." When this enzyme is inhibited, it is often easier for the cardiovascular system to regulate blood pressure. The antioxidant and anti-inflammatory properties of soy peptides found in fermented soy food like tofu can help protect the blood vessels from oxidative and inflammatory damage.

Intake of soy foods (especially whole soy foods) has been associated with improved levels of blood fats in numerous research studies. However, even in the case of whole soy foods, we would not describe this improvement of blood fat levels as being "strong." A better word would be "moderate." The most consistent effect of soybean intake on blood fats has been a moderate lowering of LDL cholesterol. Some studies show other positive impacts on blood fats, like the lowering of triglycerides and total cholesterol or the raising of HDL cholesterol (the "good" cholesterol). However, these additional blood fat results have not been confirmed in all studies.

Soyasaponins are soy phytonutrients that have been especially interesting to researchers with respect to their cardiovascular benefits. There is some evidence, mostly in animal studies, that soyasaponins can lessen the rate of lipid peroxidation in blood vessels, lessen absorption of cholesterol from the GI tract, and increase excretion of fecal bile acids. All of these events would be expected to contribute to a decreased risk of cardiovascular disease. Soyasaponins are provided in many forms of soy, but fermentation of soy has been shown to increase their concentration. Increased levels of soyasaponins in fermented soy foods like fermented tofu are likely to play a role in the better track record of fermented (versus non-fermented) soy foods in the area of cardiovascular benefits.

Cancer Prevention Benefits

The area of cancer prevention is a controversial area of health research on soybeans. Many studies provide us with evidence that supports the role of whole soy foods in a cancer-preventing diet. Genistein (an isoflavone phytonutrient in soy) is often a key focus in these cancer-prevention studies. This soy isoflavone can increase activity of a tumor suppressor protein called p53. When p53 becomes more active, it can help trigger programmed cell death (apoptosis) in cancer cells, and it also help trigger cell cycle arrest (helping stop ongoing cancer cell activity). Genistein has also been shown to block the activity of protein kinases in a way that can help slow tumor formation, especially in the case of breast and prostate cancer. Importantly, genistein is found in higher concentrations in fermented soy foods like fermented tofu (compared to non-fermented soy foods like soymilk, isolate soy protein, concentrated soy protein, textured soy protein—also known as TVP—and non-fermented tofu).

Even in the case of fermented soy foods and their higher concentration of isoflavones like genistein, however, the potential cancer-related benefits of soy are complicated by other real-life factors. For example, the lifecycle and metabolic status of an individual seems to make a potentially important difference in the anticancer benefits of soy (even fermented soy). In studies on soy intake and breast cancer involving women who are pre-menopausal and develop tumors that are neither estrogen receptor positive nor progesterone receptor positive, soy and genistein intake (even from fermented soy foods) does not appear to offer risk reduction. Overall dietary intake may also make an important difference in the anticancer benefits of soy. For example, without strong dietary intake of fresh fruits and vegetables, even fermented soy foods may not provide reliable anticancer benefits.

In several studies, large doses of purified soy isoflavones (obtained through dietary supplements) has been associated with increased risk of certain cancers, including breast cancer. This evidence should not be surprising. Under certain metabolic circumstances, most antioxidant, anti-inflammatory, and anti-tumor compounds can also act in a way that is pro-oxidant, pro-inflammatory, and pro-tumor (often called a "proliferative" effect that is promoting of tumor growth). We view intake of tofu (especially fermented tofu) as very different from intake of highly processed forms of soy, or intake of dietary supplements containing purified soy components. And our recommendations to you based on all of this information are as follows:

First, if you have a family history of hormone-related cancers like breast cancer or prostate cancer, we recommend that you consult with your healthcare provider before consuming very large amounts of soy in your diet (for example, 3 or more servings per day). This recommendation holds true for both non-fermented and fermented soy foods. And while this recommendation is a conservative one on our part, we believe that it's justified based on the current level of controversy in the health research on soy.

Second, we recommend that you choose whole food soybeans whenever possible, rather than highly processed versions like soy protein isolates and soy protein concentrates. Especially good choices in this context would be whole food-type soy products that have also been fermented, like fermented tofu. In general, it's worth remembering that fermented soy foods have a better track record in cancer prevention than non-fermented soy products.

Other Areas of Potential Health Benefit

There are several other areas of potential health benefit from tofu that we believe deserve special mention. First is prevention and treatment of obesity. In this context, it is some of the unique peptides (protein breakdown products) in soy that have been associated with obesity prevention and treatment. Some of these peptides have shown the ability to decrease synthesis of SREBPs (sterol regulatory element binding proteins), thereby helping decrease synthesis of certain fatty acids as well as the depositing of these fatty acids in fat cells. Since fermented soy foods like fermented tofu have increased concentrations of bioactive peptides (versus non-fermented soy foods), fermented tofu may turn out to be premier forms of soy with respect to obesity management. However, it's important to remember that this fascinating research on soy and obesity is still in a very early stage.

A second area of potential health benefit is prevention of type 2 diabetes. In multiple animal studies, soy foods have been shown to lessen insulin resistance by increasing the synthesis of insulin receptors. However, this increased formation of insulin receptors only appears to occur in the presence of other dietary circumstances, like a moderate amount of polyunsaturated fat intake. High levels of total soy intake (approximately 200 grams per day) have also been associated with decreased risk of type 2 diabetes, but only in Asian populations thus far. We have yet to see specific studies on tofu in this regard, but we look forward to more research in this area.

Other areas of active research on soy and health include chronic obstructive pulmonary disease (COPD), periodontal disease, and neurodegenerative disease. While we have yet to see studies on tofu in these areas, we expect to learn more about potential benefits of tofu in these areas.

Description

Originating in China well over a thousand years ago, tofu is made by curdling soymilk so that soymilk proteins become coagulated. The resulting soy curds can then pressed into a sliceable cake. "Nigari" tofu typically refers to soymilk that has been coagulated with the addition of magnesium chloride. Gypsum (calcium sulfate) is another coagulant that is widely used to curdle soymilk. Both calcium sulfate and magnesium chloride are also referred to as "salt" coagulants. ("Salt" in this case doesn't mean table salt, i.e., sodium chloride. Salt is used in this context in a chemical way to refer to any ionic compound.) "Acid" coagulants like glucono delta-lactone (GDL) are also used to coagulate tofu in a way that produces a softer version of this soy food, often referred to as "silken" tofu. Because tofu is "curded" soymilk, tofu is also often called "bean curd." In Chinese, tofu would more accurately be spelled "doufu." Today there are over 200,000 manufacturers of tofu worldwide.

The vast majority of tofu sold in the United States has not been fermented. However, many forms of fermented tofu are widely enjoyed worldwide. You will read and hear about fermented tofu being described using a seemingly endless list of terms, including: pickled tofu, preserved tofu, tofu cheese, Chinese cheese, sufu, sufu cheese, stinky curd, stinky tofu, and stinky sufu. All of these terms refer to tofu that has been fermented. Fermentation of tofu can take place using a variety of methods, including the addition of bacteria and molds as well as special brines.

There's little question in the research about the added health benefits that can come from fermentation of tofu. To understand these health benefits, however, it can be helpful to think not only about fermentation of tofu, but about fermentation of foods in general.

Fermentation of Soy and Other Foods

Fermentation of food typically involves the breakdown of a food's carbohydrates into gasses, alcohols, and other molecules by micro-organisms. These micro-organisms include molds, yeasts, and bacteria. Common examples of fermented food include beer and wine, cider, leavened bread, yogurt, and sauerkraut. Interestingly, a relatively small number of micro-organisms account for a very large percent of commercially fermented foods, and an even smaller number account for most fermented soy foods. Fermented soy foods (including fermented tofu) usually involve the activity of the molds *Aspergillus*, *Rhizopus*, *Mucor*, *Actinomucor* and *Neurospora*; several species of the yeast *Saccharomycces*; and numerous species of the bacteria *Bacillus* and *Pediococcus*.

While fermentation is usually defined in terms of the action of micro-organisms on a food's carbohydrates, many nutrients in food can be transformed during the process of fermentation. These nutrients can include the food's proteins, fats. vitamins, minerals, and phytonutrients. In fermented soy foods, for example, proteins are often made more digestible through fermentation. Minerals like calcium in soy foods can become more soluble and bioavailable through fermentation as can the bioavailability of many phytonutrients, including isoflavones like genistein and daidzein. In some cases, when fermentation changes the digestibility of protein in soy foods (and in other foods as well), smaller protein fragments are created (called peptides) that have unique health supportive properties of their own. For example, one of the important storage proteins in soybeans is called conglycinin. Conglycinin and its fellow storage protein, glycinin, account for as much as 80% of the total proteins in soybeans. During the process of fermentation, conglycinin in soy is often broken down into smaller peptides that serve as antioxidants, boost immune function, and prevent excessive inflammatory response.

In the overall picture, we believe that non-fermented soy foods like non-fermented tofu (or a non-fermented fresh green soybean food like edamame) can provide you with important health benefits. (To learn more about these overall soy benefits, please refer to our food profile for Soybeans.) We believe that these whole food-based forms of soy stand in clear distinction to highly processed versions of soy like soy protein concentrate or soy protein isolate. So we recommend that you consider adding any whole-food form of soy to your diet. At the same time, we also believe that the research support for the health benefits of soy foods is even stronger for fermented versus non-fermented soy foods. So we also encourage you to consider inclusion of fermented soy food—such as fermented tofu—among your whole soy choices.

History

Along with miso, tofu was a favored food as early as the 12th century AD in Japan, regularly enjoyed by military rulers (Shoguns) and at Zen Buddhist temples throughout the country. In fact, tofu became one of the primary ingredients in "Zen Temple Cookery" (Shojin Ryori) during this time period. Tofu provided a common bond of sorts between common persons, monks, and other officials whose lives were more closely connected with the world of and monasteries. To this day, tofu is viewed as a common food that is both nourishing and inexpensive and can be enjoyed by all.

How to Select and Store

Tofu is available refrigerated in individual packages or in bulk, or non-refrigerated in aseptically sealed containers. Packaged tofu should feature expiration dates, which you can use as a guideline for how long of a shelf life it will have. Tofu varies in texture from soft to firm to extra-firm. Soft tofu has a smoother texture and is therefore better suited for salad dressings, sauces, and desserts. Firm and extra-firm tofu are best for baking, stir-frying, and grilling.

While aseptically packaged tofu need not be refrigerated until it is opened, all other forms of tofu should be refrigerated in their container. Once their packages are open, all types should be rinsed well, kept in a container covered with water, and placed in the refrigerator. Changing the water daily will help keep the tofu fresh for up to one week.

Tofu can also be frozen in its original packaging and will keep this way for up to five months. This process will actually alter its texture and color, making it more spongy and absorbent, and more yellowish in color. This change in physical properties is actually very suitable for certain recipe preparations.

If you are selecting tofu on the basis of fat content, the firmer tofus are usually the highest in fat, and the softest tofus, often called silky or silken, are the lowest.

If you are looking for tofu with higher calcium content, look for products that specifically say "calcium-precipitated" on the label or that include calcium sulfate in their ingredient list. This method of tofu manufacturing uses calcium to help coagulate the soy milk. You'll also sometimes find the word "gypsum" being used to describe tofu coagulants, and this word refers to calcium sulfate as well.

If you are looking for tofu with higher magnesium content, look for products that say "nigari tofu" or "prepared from nigari flakes" on the label. In this context, "nigari" usually refers to a magnesium chloride coagulant that has been used to curdle the soymilk.

Finally, if you are looking for a tofu that is more easily digested and more likely to contain nutrients in forms that are better absorbed, look for fermented tofu. As described earlier, you will find a wide variety of terms being used to describe fermented tofu, including pickled tofu, preserved tofu, tofu cheese, Chinese cheese, sufu, sufu cheese, stinky curd, stinky tofu, and stinky sufu.

How to Enjoy

For some of our favorite recipes, click Recipes.

A Few Quick Serving Ideas for Tofu

- Blend together soft tofu, olive oil, garlic and lemon juice to make a tofu aoli dip.
- Scramble soft tofu together with your favorite vegetables and the spice turmeric to give it a yellow "egg-like" coloring. This delicious dish can be served as is or can be used as the basis for "tofu rancheros" by being wrapped in a tortilla and served with black beans and salsa.
- Healthy Stir-Fry firm tofu with your favorite vegetables and seasonings.
- Blend soft tofu with your favorite fruits (and honey or other natural sweeteners to taste) in a blender or food processor and serve for breakfast or dessert.
- Add cubes of tofu to miso soup.

Safety

Tofu and Food Allergies

Soybeans and the foods made from them, including tofu, are among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions

Tofu and Thyroid Health

Along with the increasing presence of soy foods (such as tofu) in grocery stores and on restaurant menus has come increasing controversy over soybeans and thyroid health. We're not surprised to find strong conflicting opinions in this area because scientific research on thyroid and soy is both complicated and inconclusive. We have written an extensive review of what we know—and what we don't know—about this important issue at this point. You find the article Soy Food and Thyroid Health here.

Genetically Modified Soybeans

Conventionally grown soybeans&mash;from which conventional tofu is made—is one of the foods that is often grown from genetically modified seeds. For helpful information about genetically modified foods—including our WHFoods Recommendations—please see our article, What Is Your Approach to Genetically Modified Foods?

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Tofu, firm
4.00 oz
113.40 grams

Calories: 164
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
calcium	774.51 mg	77	8.5	excellent
manganese	1.34 mg	67	7.3	very good
copper	0.43 mg	48	5.2	very good
selenium	19.73 mcg	36	3.9	very good
protein	17.89 g	36	3.9	very good
phosphorus	215.46 mg	31	3.4	very good
omega-3 fats	0.66 g	28	3.0	good
iron	3.02 mg	17	1.8	good
magnesium	65.77 mg	16	1.8	good
zinc	1.78 mg	16	1.8	good
vitamin B1	0.18 mg	15	1.6	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Beef, grass-fed

Grass feeding is a practice not yet familiar to all consumers. 100% grass-fed beef comes from cows who have grazed in pasture year-round rather than being fed a processed diet for much of their life. Grass feeding improves the quality of beef, and makes the beef richer in omega-3 fats, vitamin E, beta-carotene, and CLA (a beneficial fatty acid named conjugated linoleic acid. (For more detailed information about grass feeding, please click here.) Just how important is grass feeding for beef quality? As you will see in the chart below, we have included grass-feeding as one of our top-level recommendations for anyone who plans to include beef in their meal plan:

Shopping for Beef	
Stick with organic	Organic standards help lower risk of contaminated feed and organic beef usually has higher nutrient quality. However, remember that organic by itself does not guarantee a natural lifestyle for the beef cows.
Ask for 100% grass-fed	Go beyond organic by asking for 100% grass-fed. Don't get sidetracked by the confusing array of labeling terms like natural" or "pasture-raised." Labeling laws allow products to display these terms even if cows spend little or no time outdoors in a pasture setting. Unfortunately, even the term "grass-fed" is not sufficient since grass-fed cows may have spent a relatively small amount of time grass feeding. The standard to look for on the label is "100% grass-fed." Talk to your grocer or the cow farmer and find out how the animals were actually raised. In addition, if you would like more information about the practice of grass-feeding, please click here.
Consider local farms	Organic, 100% grass-fed beef may be available from local farms with small flocks, which provide a natural lifestyle for their cows. Two websites that can help you find small local farms in your area are www.localharvest.org and www.eatwild.com. Both sites are searchable by zip code.

One thing you'll notice about the chart above is an absence of recommendations about specific cuts of beef. In general, we recommend sticking with lower fat cuts of beef if you decide to include this food in your meal plan. Lower fat cuts include top round, bottom round, eye of round, flank, and strip. Health organizations have traditionally recommended avoidance of higher fat cuts like tenderloin, ribeye, or porterhouse because it can be difficult to make room for the amount of total fat, saturated fat, and calories they contain. Since too much total fat, too much saturated fat, and too many calories in a daily meal plan can raise the risk of certain health problems, this approach makes sense to us, particularly in light of the fact that lower fat beef cut can still provide you with the nutritional benefits of 100% grass-fed beef in terms of omega-3s, CLA, beta-carotene, and vitamin E.

What's New and Beneficial About Grass-Fed Beef

- Recent studies have underscored the large difference in carotenoid content between grass-fed and conventionally fed beef. Grass-fed beef may contain more than twice the amount of beta-carotene and lutein that is present in conventionally fed beef. This relationship appears to hold true even if the cows have been fed silage during the winter months and pasture-feed only during the summer. In addition, some researchers have suggested that the yellowish color of fat in grass-fed beef is a good way to determine the extent to which the animals have been pasture-fed.
- The cholesterol content of grass-fed beef has repeated been shown to be lower than the cholesterol content in beef from conventionally fed animals. The decrease in cholesterol that you are most likely to obtain when switching from conventionally fed to grass-fed beef is approximately 22–39%. Since a single 4-ounce serving of conventionally fed beef will typically provide you with 90 milligrams of cholesterol or more, and since the recommended limit from the American Heart Association is 300 milligrams per day (and only 200 milligrams if you are a person who has experienced heart disease or has an LDL cholesterol of 100 mg/dL or more), this 22-39% decrease in cholesterol from grass-fed beef could be very helpful to you in helping you keep your total cholesterol intake under the recommended limit.
- You'll find yourself getting 500-800 milligrams of CLA (conjugated linoleic acid) from a 4-ounce serving of grass-fed beef. This amount is approximately two to three times greater than the amount found in non grass-fed beef. CLA is a fatty acid made from linoleic acid, an omega-6 fatty acid commonly found in food. However, CLA is unique in its chemical structure, and this uniqueness is associated with an increasing list of health benefits, including immune and inflammatory system support, improved bone mass, improved blood sugar regulation, reduced body fat, reduced risk of heart attack, and maintenance of lean body mass. Grass-fed beef also contains greater amounts of vaccenic acid than conventionally fed beef. Various bacteria in our digestive tract are able to convert vaccenic acid into CLA once we've consumed grass-fed beef, and this process can further increase the practical amount of CLA that we receive from grass-fed animals.

- The omega-3 fat content of grass-fed beef varies widely, due to the wide variety of forage crops that can be planted in pastures (or that grow on pastureland in the wild); the age, breed, and health of cows; and seasonal plant cycles in pastureland. Some recent studies show up to 3.5 grams of total omega-3 fats in 4 ounces of grass-fed beef. That level would provide you with 100% of the daily requirement. In other recent studies, total omega-3s in grass-fed beef only reached 1 gram. Still, a single gram of omega-3s could make an important contribution to a person's health. Most of the omega-3 content of grass-fed beef comes in the form of alpha-linolenic acid, or ALA. However, grass-fed beef also typically contains small-to-moderate amounts of other omega-3s, including EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid). The range we've seen in recent studies is 20-720 milligrams for EPA, and 10-120 milligrams for DHA. In all cases described above, grass-fed beef contained greater amounts of omega-3s (for ALA, EPA, and DHA) than conventionally fed beef.

Beef, grass-fed, strip steak, cooked
4.00 oz
(113.40 grams)

Calories: 175
GI: very low

Nutrient	DRI/DV
vitamin B12	60%
protein	52%
vitamin B3	48%
omega-3 fats	46%
vitamin B6	44%
selenium	44%
zinc	37%
phosphorus	34%
choline	17%
pantothenic acid	15%

Health Benefits

Broad-Based Nutrient Support

A recent study of children and teens in the U.S. has shown that individuals in these age groups depend on their intake of beef for the following key nutrients and in the following amounts.

- Vitamin B12: beef provides 14-21% of this B vitamin to U.S. children and teenagers
- Zinc: 13-19% of this mineral is provided by beef to these age groups
- Vitamin B3: U.S. children and teens receive 6-10% of their vitamin B3 from beef
- Vitamin B6: 5-8% of this vitamin is provided by beef to these age groups
- Iron: up to 8% of dietary iron is provided to these age groups by beef

Additionally, beef is an important source of potassium, phosphorus, and protein to these age groups in the U.S. population. Very few U.S. children and teenagers—and equally few U.S. adults—consume grass-fed versus conventionally fed beef. For this reason, we do not have data showing the potential contribution of grass-fed beef to other categories of nutrient consumption. However, we do have research evidence about the average composition of grass-fed versus conventionally fed beef, and this research evidence points to significant differences for the following key nutrients.

- Vitamin E: repeatedly show to be higher in grass-fed beef, sometimes at a level that is three times higher than conventional feeding
- Beta-carotene: shown in several studies to be significantly higher in grass-fed beef, and often at levels twice as high as the amount found in conventionally fed beef. Beta-carotene is not the only carotenoid phytonutrient that increases with grass feeding. The carotenoid lutein increases as well. This relationship between grass feeding and carotenoids appears to hold true even if the cows have been fed silage during the winter months and are pasture-fed only during summer months. The relationship between beta-carotene and grass-feeding in beef is so strong that some researchers have suggested that the yellowish color of fat in grass-fed beef can be used as a good way to determine the extent to which animals have been pasture-fed.
- Omega-3 fatty acids: because many forage plants contain the omega-3 fatty acid alpha-linolenic acid (ALA), cows that forage in a pasture typically get higher levels of ALA in their diet. This ALA gets passed on to us when we eat beef, drink milk, or consume dairy products from cows like cheese or yogurt. The omega-3 fat content of grass-fed beef varies widely due to the wide variety of forage crops that can be planted in pastures (or that grow on pastureland in the wild); the age, breed, and health of cows; and seasonal plant cycles in pastureland. Some recent studies show up to 3.5 grams

of total omega-3 fats in 4 ounces of grass-fed beef. That level would provide you with 100% of the daily requirement. In other recent studies, total omega-3s in grass-fed beef only reached 1 gram. Still, a single gram of omega-3s could make an important contribution to a person's health. Since ALA is the most common omega-3 fatty acid in the plants that cows eat on pastureland, most of the omega-3 content of grass-fed beef comes in the form of ALA. However, just like humans, cows are capable of taking the ALA in their diet and converting some of it into other omega-3 fats, including EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid). The range we've seen in recent studies for EPA and DHA in grass-fed beef is 20-720 milligrams for EPA and 10-120 milligrams for DHA. While the lower end of these ranges is relatively small (and far lower, for example, than the amount of EPA and DHA contained in many fish), it is still significant from a health standpoint. Additionally, in all of the research that we have reviewed, grass-fed beef has contained greater amounts of omega-3s than conventionally fed beef.

When combined with the B vitamins and minerals listed above, these additional nutrients specifically associated with grass-feeding of beef—including vitamin E, beta-carotene, and omega-3s—make grass-fed beef unusually diverse in terms of its potential for nutrient support of health. Our food rating system also ranks grass-fed beef as a very good source of the antioxidant mineral selenium and a good source of the B-vitamin choline.

Conjugated Linoleic Acid CLA and Vaccenic Acid

Conjugated linoleic acid (CLA) is a fatty acid made from linoleic acid, an omega-6 fatty acid commonly found in food. However, linoleic acid is not commonly converted into CLA in significant amounts, making CLA much more rare in food. The unique structure of CLA is associated with an increasing list of health benefits, including immune and inflammatory system support, improved bone mass, improved blood sugar regulation, reduced body fat, and maintenance of lean body mass.

You'll find yourself getting 500-800 milligrams of CLA from a 4-ounce serving of grass-fed beef. This amount is approximately two to three times greater than the amount found in non grass-fed beef.

In addition to CLA, you will also find yourself getting a fatty acid called vaccenic acid from grass-fed beef. (Grass-fed beef contains greater amounts of vaccenic acid than conventionally fed beef.) Since various bacteria in our digestive tract can convert vaccenic acid into CLA once grass-fed beef has been consumed, this vaccenic acid supplied by grass-fed beef can further increase the practical amount of CLA that we receive from grass-fed animals.

Immune and Inflammatory Support

We have yet to see large-scale human studies showing decreased risk of chronic immune and inflammatory health problems following routine intake of grass-fed beef. Future results along these lines would not surprise us, since grass-fed beef can provide substantial amounts of the antioxidant vitamins E and beta-carotene, the antioxidant minerals selenium and zinc, and the anti-inflammatory fatty acid CLA. (For the cows themselves, research studies have already shown greater antioxidant capacity in their cells brought about by grass-feeding, as well as stronger performance of antioxidant enzymes like superoxide dismutase. In fact, grass feeding of cows has been shown to do a better job of increasing their antioxidant capacity than supplying them with antioxidant supplements.) Exactly how much these results will extend to humans will most likely depend on the role played by grass-fed beef in the overall diet. While rich in the potential for anti-oxidant and anti-inflammatory support, grass-fed beef also harbors the potential for excessive intake of nutrients like saturated fat and cholesterol when consumed in excessive amounts. It's exactly for this reason that we've recommended avoidance of large portions of grass-fed beef in your everyday meal (along the lines of a 12-ounce steak in the center of your plate that would be providing over half of the calories in your meal). Instead, we recommend an average serving size for grass-fed beef of approximately 4 ounces, whether added to a salad, stir-fry, sauce or other recipe.

Description

Beef is a general term used to describe the flesh derived from animals belonging to the *Bovidae* family of animals, and more specifically, to the genus called *Bos*. This *Bos* category includes the species *Bos Taurus* and *Bos indicus*. While people commonly use the word "cow" to refer to this group of animals as a whole (a practice that we have also adopted throughout our website), the word "cow" is used in a more much specific way within the beef industry. Within this industry, "cow beef" is just one type of beef. Here are the four basic types of beef found in today's marketplace.

- Cow Beef: beef obtained from a mature female who had already calved at least once
- Heifer Beef: beef obtained from a mature female who had never calved
- Steer Beef: beef obtained from a mature male who had been castrated before the ability to reproduce
- Bull Beef: beef obtained from a mature uncastrated male who was old enough to reproduce

Not typically found in the marketplace is "stag beef" (beef obtained from a mature male who had been castrated after the ability to reproduce).

There are over 800 different breeds of beef cows. Some of the most common are Angus, Aberdeen Angus, Beefmaster, Brahman (Zebu), Hereford, (Whiteface), Jersey, Santa Gertrudis, Shortghorn, and Texas Longhorn.

Among all 97.8 million cows in the U.S., about 9.3 million are dairy cows. The total cow population also includes 30.5 million beef cows (in the strict sense of mature females who have calved), 14 million beef steers (mature males castrated before the ability to reproduce), 15.7 million beef heifers (mature females who have never calved), and 26.5 million calves.

Beef is available in a wide variety of cuts that can fulfill many different recipe needs. The different cuts range in texture and tenderness as well as in fat content. The leanest cuts of beef are taken from the back leg bone, called the round bone. These include eye of round, top round, and bottom round. These cuts are the leanest (most muscular) because the cow uses its back legs as its primary means of movement. The underbelly, including rib, ribeye, spare rib, and brisket, is the site of the fattiest cuts.

The term "grass-fed" was only officially applied to beef by the U.S. Department of Agriculture's (USDA) Agricultural Marketing Service (AMS) in 2007. Producers of grass-fed beef are not required to comply with the USDA standards, unless they want to display the USDA grass-fed shield on their product labeling.

Standards for displaying the USDA's grass-fed shield have been controversial. In order to qualify for the shield, producers of grass-fed beef only need to make continuous access to pasture available during the growing season (the period of time between average final frost and the average subsequent first frost). This guideline allows for potential confinement of grass-fed cows during the rest of the year. Producers of grass-fed beef may also display the shield while allowing their cows to consume corn, wheat, and other grains, but only if those grains are foraged and/or harvested for silage in their vegetative state before they have reached the mature seed stage of growth. Many different types of forage are permitted under the USDA labeling guidelines, including annual grasses, perennial grasses, legumes, *Brassica* vegetables, "browse" (the leaves of woody plants like shrubs) and seeds (except for the seeds of grains).

The American Grassfed Association (AGA) and The American Food Alliance (AFA) are organizations that offer alternative certification for grass-fed beef. AFA and AGA requirements for use of grass-fed labeling are stricter than USDA requirements. In particular, they require a much smaller period of confinement not to exceed 30 days per calendar year. The Food Safety and Inspection Service (FSIS) of the USDA honors both AGA and AFA grass-fed labels and automatically allows beef producers who have qualified for the AGA/AFA labels to display the USDA shield. So when you see the AGA or AFA certifications, you can also be sure that your beef meets the USDA grass-fed standards.

This is what the American Grassfed Association label looks like:

This is what the American Food Alliance label looks like:

As presented as a "BEST CHOICE" recommendation in our chart at the beginning of this food profile, we recommend that you purchase grass-fed beef that displays the USDA shield, the AGA label, the AFA label, or another grass-fed label issued by a certifying agency with similar standards for the grass-feeding of cows. One of our main reasons for this recommendation involves "finishing." We have seen many beef products that use the words "grass-fed" even though the cows involved were only "finished" on pasture. "Finished" is the term used by the beef industry for the feeding of cows during the last 2-3 months prior to slaughter. This period of time has no legal definition and can sometimes vary more widely. Prior to "finishing," a cow may have experienced little or no pasture feeding. When not at pasture, cows are typically confined to feedlots and fed a mixture of concentrates, protein supplements, silages and forages, often combined together in products called total mixed rations (TMRs). "Concentrates" are nutrient-dense composite feeds, often containing corn meal, corn gluten, barley, molasses, citrus pulp, soy protein, urea, and other components.

There is yet another reason why we recommend certified versus non-certified grass-fed beef. From our perspective, grass feeding is not simply a question of what a cow puts into his or her mouth. It's more a question about the lifestyle that is natural for cows, involving exercise and fresh air and plant food that would naturally be available in their environment. Grass-fed certifying organizations have often paid attention to these factors and have established standards that attempt address these factors in varying degrees.

History

Cows may have first been domesticated as early as 7000-8000 BC, beginning in the region of the Eastern Mediterranean around the Tigris and Euphrates Rivers which eventually came to be known as Mesopotamia. Several thousand years later, there is evidence of domestication in China, Korea, and Mongolia, as well as northern Africa. It was not only the meat, milk, and blood of cows that cultures found valuable but also their ability to serve as draft animals which could help with plowing, trampling grain, powering grind wheels, pulling logs, and transporting carts and wagons. Today, the word "oxen" is typically used to refer to castrated male cows that are used for work purposes.

Columbus brought cattle on his second voyage to North America in 1493, and it's clear that when Columbus helped found Spanish colonies in Hispaniola in the Caribbean that expanded over the next decades, cattle herds played a key role in the viability of the colonies. Cows were present in the colony of Jamestown by 1611, and many European colonists came to own cows over the course of the 17th century.

As mentioned previously, the present-day size of the cow population in the U.S. is close to 100 million, including some 60 million cows being raised for beef. Annual per person beef consumption in the U.S. peaked at 184 pounds per person (almost exactly 1/2 pound per day) in 2004 and now averages approximately 166 pounds, or about 10% less over a period of about 10 years.

How to Select and Store

When you are at the grocery store, purchase raw meats last. Since raw meats may contaminate other grocery items, keep fresh meats apart from other items. Put raw meat packages in a plastic bag, so juices won't drip onto other foods. If it will take you more than an hour to get home, pack raw meats in an ice chest, and keep the ice chest in the passenger area of the car during warm weather. Take meats straight home to the refrigerator or freezer.

There are a few clues you can look for that will help you choose fresher quality beef. Always examine the sell-by date on the label and choose the beef with the latest date. The muscle portion of the meat should be a red or purplish color and not brown, which is a signal that the meat has been excessively exposed to oxygen and is spoiled. Purchase beef that has the least amount of fat. As previously explained, the leanest cuts of beef are taken from the back leg bone, called the round bone. These include eye of round, top round, and bottom round. These cuts are the leanest (most muscular) because the cow uses its back legs as its primary means of movement. The round is your best cut for lean, low-fat beef. Other lean cuts of beef include strip steak and flank steak. While some website include sirloin and T-bone in the lean cut category, these cuts are usually about 30-50% higher in total fat.

If you are purchasing ground beef, you are most likely to find labeling that reads, "Fat not to exceed 15%" or a similar statement with a different percentage, for example "12%" or "10%" or in some rare cases "5%." Percent fat labels are both confusing and misleading, because these percentages do *not* refer to percent of calories but to percent of the product by weight.

Ground beef that is 15% fat by weight is actually 55% fat in terms of calories, and ground beef that is 10% fat by weight gets 44% of its calories from fat. Both types of ground beef exceed the fat content that we recommend. Please note that 5% ground beef brings the percent fat from calories down to approximately 25%, and that's a level makes sense to us.

Unfortunately, however, we almost never see ground beef in groceries that is labeled "Fat not to exceed 5%." For this reason, we recommend taking a lean cut of pre-packaged beef with the amount you wish to purchase from the meat section, bringing it to the in-store butcher, and requesting that it be ground for you. (Remember that lean cuts include top round, bottom round, eye of round, strip, and flank.) Alternatively, you could ask an in-store butcher to grind up whatever amount of lean beef you want from beef that has yet to be packaged and displayed for purchase.

Whenever possible, we recommend that you purchase not only certified grass-fed beef, but also certified organic beef. Certified organic beef is much less likely to expose you to unwanted pesticide, antibiotic, or hormone residues and it is also illegal for certified organic beef to have been genetically modified or irradiated.

Since beef is highly perishable, it should always be kept at cold temperatures, either refrigerated or frozen. Refrigerate the beef in the original store packaging, if it is still intact and secure, as this will reduce the amount of handling involved. Length of storage varies with the cut of beef as larger pieces will have a longer shelf life than pieces with increased surface area. Ground beef will keep for about one to two days, steaks for two to three days, and roasts for three to four days.

If you have more beef than you can use within this period of time, you can freeze it in a cold temperature freezer. Using freezer paper, wrap the beef carefully so that it is as tightly packaged as possible. Ground beef should be able to keep for two to three months, while steaks should keep for about six months.

How to Enjoy

A Few Quick Serving Ideas

- Healthy sauté thin slices of steak with onions, garlic, fresh basil, lemongrass and chili peppers for a southeast Asian inspired meal.
- Add 2-4 ounces of grass-fed ground beef to tomato sauce and serve over pasta.

Safety

Risk of Contamination

Over the past 15 years, over 250 million pounds of beef have been recalled for contamination reasons by food companies and meat packers across the United States. The largest single recall affected more than 10,000 supermarkets, restaurants, retailers, school districts, and other establishments. Well-known companies like ConAgra have been involved in some of the largest recalls. Several hundred cases of illness and seven deaths were documented over this time period in association with contaminated beef.

By far the most problematic of the beef contaminants has been the bacterium *E. coli 0157:H7*. Seven different strains of *E.coli* have been involved in contamination problems (including EPEC, ETEC, EIEC, EAEC, VTEC, DAEC, and NTEC). Contamination has been detected in a variety of different settings, including pre-slaughter, processing and packing, distribution, retail handling, retail cooking, and home storage. One recent study has predicted that over 99% of all beef contamination could be prevented by a combination of comprehensive and aggressive sanitation steps during all stages of the beef production process. These sanitation steps would include more effective use of vaccines, antibiotics, and probiotics prior to slaughter; more consistent use of carcass washes, acid spray chill, and steam pasteurization during processing; improved freezing and chilling during packing and distribution; improved consumer handling and storing post-purchase; and better cooking temperature control in homes and restaurants. However, these pre-processing, processing, and post-processing steps do not adequately address contamination problems in the minds of many experts familiar with beef industry practices. In their view, contamination with micro-organisms like *E. coli* is inextricably tied to the unnatural habitat and lifestyle in which beef cattle are required to participate.

Irradiation of Beef

The U.S. Food and Drug Administration (FDA) first approved irradiation of beef in December 1997 following problematic recall of 25 million pounds of beef processed through the Columbus, Nebraska beef packing plant owned by the Hudson Foods Company in Rogers, Arkansas. The beef had become contaminated with *E. coli 0157:H7*. (The Nebraska packing plant had originally been established to supply beef exclusively for Burger King restaurants beginning in 1995.) Irradiation of beef effectively kills micro-organisms (including *E. coli 0157:H7*) that may be present in the beef. Raw beef is typically passed along a conveyor belt and very briefly exposed to gamma irradiation from in the range of 4.5-7.0kGy. While radioactive isotopes of cobalt-60 or cesium-137 have traditionally been used as sources of irradiation, electron beam irradiation and x-ray irradiation are also possible. In practice, few facilities in the U.S. commonly irradiate large amounts of beef, and approximately 5-10% of all U.S. beef is currently irradiated. When prepackaged and sold by retail groceries, irradiated beef is required by the FDA to carry a label that includes this radura symbol.

Like contamination with micro-organisms like *E. coli* , many experts who are knowledgeable about the beef industry question the appropriateness of irradiation from radioactive isotopes, electron beams or x-rays as a solution to problems with beef contamination problems. In their view, potentially contaminated beef should be removed from the marketplace rather than irradiated for future consumption.

Excessive Greenhouse Gases Released During Beef Production

The potential contribution of commercial beef production to global warming is a further concern for many individuals who try to evaluate the appropriateness of beef in their diet. Manure from commercial beef feedlots is a primary contributor to release of methane gas into the atmosphere from the agricultural sector of the U.S. economy, and along with carbon dioxide and nitrous oxide, methane gas is one of the primary problematic greenhouse gases (GHGs) that has been increasing at an unhealthy rate in the earth's atmosphere. Nitrous oxide is a second GHG that has been tracked to commercial beef production due to heavy use of nitrogen-containing fertilizers used in the production of feedstuffs for beef cattle. One of the reasons we recommend grass-fed beef involves the ability of grass feeding to help offset GHG release by reducing atmosphere carbon dioxide. (When pastures are filled with green plants, these plants can take in significant amounts of atmospheric carbon dioxide and help lower the level of this GHG in the environment.)

Other Controversies

Some animal foods and some plants foods have been the subject of ongoing controversy that extends well beyond the scope of food, nutrient-richness, and personal health. This controversy often involves environmental issues, or issues related to the natural lifestyle of animals or to the native habitat for plants. Beef has been a topic of ongoing controversy in this regard. Our Controversial Foods Q & A will provide you with more detailed information about these issues.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Beef, grass-fed, strip steak, cooked
4.00 oz
113.40 grams

Calories: 175
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin B12	1.44 mcg	60	6.2	very good
protein	26.16 g	52	5.4	very good
vitamin B3	7.60 mg	48	4.9	very good
omega-3 fats	1.10 g	46	4.7	very good
vitamin B6	0.74 mg	44	4.5	very good
selenium	23.93 mcg	44	4.5	very good
zinc	4.09 mg	37	3.8	very good
phosphorus	240.40 mg	34	3.5	very good
choline	73.82 mg	17	1.8	good
pantothenic acid	0.77 mg	15	1.6	good

World's Healthiest	

Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Chicken, pasture-raised

Shopping for Chicken	
Stick with organic	Organic standards help lower risk of contaminated feed and organic chicken usually has higher nutrient quality. However, remember that organic by itself does not guarantee a natural lifestyle for the chickens.
Ask for pasture-raised	Go beyond organic by asking for pasture-raised. Don't get sidetracked by the confusing array of labeling terms. You are likely to find phrases like "pasture-raised," "pastured," "free-range" and "cage-free" on chicken meat packaging, but labeling laws allow products to display these terms even if the chickens spend little or no time outdoors in a pasture setting. Talk to your grocer or the chicken farmer and find out how the animals were actually raised.
Consider local farms	Organic, pasture-raised chicken may be available from local farms with small flocks and a natural lifestyle for their chickens. Two websites that can help you find small local farms in your area are www.localharvest.org and www.eatwild.com. Both sites are searchable by zip code.

What's New and Beneficial About Chicken

- Pasture raising of chickens (with plenty of time allowed for pecking, foraging, and moving around outdoors) has been recently analyzed, with fascinating results, by a team of researchers at the University of Perugia in Perugia, Italy. In their study, conventional indoor raising of chickens was compared with organic raising (some outdoor access, but mostly higher quality feed) and also with "organic plus"—meaning organic feed with meaningful time spent outdoors. While organic standards—all by themselves—were sufficient to increase the amount of omega-3 fatty acids in breast meat obtained from the chickens, it took more than organic standards to improve the breast meat in two other important respects: increase in total antioxidant nutrients and decrease in risk of oxidative damage to fats in the meat. These additional benefits were not observed in the comparison of conventional to organic breast meat, but only in the comparison of organic-plus (pastured) to organic meat. It's worth noting that in this study, "pastured" not only meant time outdoors foraging, pecking, and moving about but also the presence of outdoor space that averaged 10 square meters per bird. The authors concluded that pasture activities were directly linked to the health quality of the meat. These findings are one key reason for our recommendation that chicken be purchased not only when certified as organic, but also when genuinely pasture-raised.
- High intake of red meat has consistently been associated with increased risk of colorectal cancer in large-scale health studies. ("High" in this context typically means a minimum of about 5 ounces per day.) Since red meat intake in most studies has not involved meat from grass-fed cows or cows raised with a natural lifestyle, we suspect that this increased risk of colon cancer risk rate might not be quite as great if the beef were higher in quality. Still, the association between high intake and increased risk has been a valid one, and one of the reasons that many people have shifted their meal plan to include less beef and more chicken. In fact, the average U.S. adult now consumes about 75-80 pounds of chicken per year compared with 50-55 pounds of beef. In light of this trend, we were very interested to see a recent study analyzing risk of colorectal cancer in more than 20 studies involving chicken, turkey, and fish intake. What the researchers found was no evidence of increased colorectal cancer risk, even when chicken was consumed four to five times per week. The study analysis also looked at the impact of very small increases in chicken intake (less than one ounce per week) and did not find increased risk of colorectal cancer as intake gradually increased from less than four ounces per week all the way up to four or more ounces per day.
- Researchers at the University of Stellenbosch in Tygerberg, South Africa have recently analyzed chicken intake for its impact on blood fats (including total cholesterol, LDL-cholesterol, and triglycerides) and they also compared this impact of chicken with the impact of red meat. All participants in this five-month study followed a prudent diet consisting of about 17% protein, 53% carbs, and 30% fat, together with an average of 20 grams of fiber per day and 200 milligrams of cholesterol. The study design included two time periods: during one time period the participants ate lean beef five days per week and lean mutton two days per week, and during a second time period, their diet contained skinless chicken five days per week and fish two days per week. Blood work during the study showed that the prudent diet helped lower total cholesterol and LDL-cholesterol regardless of whether chicken-fish or beef-mutton was eaten. However, the chicken-fish combination was shown to have more favorable effects on the composition of triglyceride (TG) fats in the blood of the participants than the lean beef-lean mutton combination. Anti-inflammatory omega-3 fats (including EPA and DHA) were higher in the TGs of participants when chicken-fish was consumed, and levels of the pro-inflammatory fatty acid arachidonic acid (AA) were lower.
- It's interesting that the researchers did not examine the difference between dark and light chicken and included both, provided that the chicken was skinless. From our perspective, the light meat versus dark meat difference is just as important as the with-skin versus without-skin difference. While a chicken breast with skin (light meat) is about 35% fat

and a chicken leg with skin (dark meat) is about 44% fat, the chicken breast drops down to about 20% fat when skinned and the chicken leg only drops down to 40%. In addition, the chicken leg starts out with and retains about 125-130 milligrams of cholesterol while the chicken breast starts out with and retains about 70-90 milligrams. We expect that the participants might have seen even greater blood fat changes if skinned, light meat chicken had been consumed exclusively in comparison to lean red meats.

- Both conventional and organic raw chicken may become contaminated with potentially problematic bacteria including *E.coli*, *Listeria*, *Campylobacter*, and *Salmonella*. (This risk of contamination is a key reason to make certain that all raw chicken has been cooked properly.) In a recent report that combined 10 studies on raw chicken and analyzed them as a group, the percentage of raw chicken samples containing the bacteria listed above was very similar in conventionally raised versus organically raised chicken. However, what was not similar was the extent to which these bacteria were antibiotic-resistant. Bacteria resistant to three or more antibiotics were found 33% more often in conventional chicken. Since antibiotics cannot be used in the production of organic chicken, but are used routinely as a disease-preventing step in the raising of conventional chicken, this finding makes sense to us and is a good reason to choose organically raised chicken. Even though proper cooking of chicken should prevent exposure to unwanted bacteria, antibiotic resistance can be a problem if a person gets sick from bacteria that don't respond as expected to antibiotics.

Chicken, pasture-raised, breast, roasted
4.00 oz
(113.40 grams)

Calories: 187
GI: very low

Nutrient	DRI/DV
vitamin B3	97%
protein	70%
selenium	57%
vitamin B6	40%
phosphorus	37%
choline	23%
pantothenic acid	22%
vitamin B12	16%

Health Benefits

Broad Nutrient Support

Chicken is perhaps best known for its high protein content, but it is a food that actually provides broad nutrient support. With respect to protein, one 4-ounce serving of pasture-raised chicken breast provides about 35 grams of protein, or 70% of the Daily Value (DV). Included in this excellent protein content are plentiful amounts of sulfur-containing amino acids like cysteine and methionine, as well as branched chain amino acids (leucine, isoleucine, and valine) that are important for support of cardiac and skeletal muscle. All B vitamins are present in chicken meat, including B1, B2, B3, B5, B6, B12, folate, biotin, and choline. (There remains controversy over the biotin content of chicken meat, which appears to be smaller than the average 10-microgram amount of biotin in chicken eggs and which seems more sensitive to the chicken's dietary intake.) Chicken is a particularly helpful food for obtaining vitamin B3, since it provides about 98% of the Dietary Reference Intake (DRI) per serving and ranks as an excellent source of this B vitamin. Four ounces of chicken breast also supplies 40% of the DRI for vitamin B6 and over 20% of the DRI for choline.

In terms of minerals, chicken is richest in selenium and provides about 57% of the DRI in a single 4-ounce serving. Zinc, copper, phosphorus, magnesium, and iron are also provided by this food.

Potential Cardiovascular Benefits

There continues to be some debate about the exact role of chicken in support of cardiovascular health. This debate is partly due to the different cuts of chicken consumed by participants in research studies. To give you a better idea of how different various forms of chicken can be in terms of their fat content, we have created the chart below.

Form of Chicken	Amount	Calories	Total Fat (grams)	Saturated Fat (grams)	Cholesterol (milligrams)
Breast with skin	100 grams	185-200	6-8	2.0-2.25	70-90
Breast without skin	100 grams	165-185	3-5	0.75-1.25	70-90
Leg with skin	100 grams	185-225	8-9	2.0-3.0	125-130

Leg without skin	100 grams	175-185	6-8	1.5-2.25	125-130
Thigh with skin	100 grams	225-235	13-16	4.0-4.25	125-135
Thigh without skin	100 grams	180-210	8-11	2.25-3.0	125-135

As you can see from this chart, the number of calories in each 100-gram serving (about 3.5-4.0 ounces) of chicken remains relatively similar and changes by a maximum of about 25% despite the presence of light versus dark meat or the presence/absence of skin. However, the total fat, saturated fat, and cholesterol content varies greatly. Since several aspects of cardiovascular health are associated with each of these fat-related nutrients, and since studies have not always been able to precisely identify which cuts were consumed (or whether skin was included), these differences may have contributed to conflicting study results.

We do know, however, from a very recent study by researchers at the University of Stellenbosch in Tygerberg, South Africa, that intake of chicken—when coupled with a prudent diet that restricts total fat to 30% of calories and provided 20 grams of daily dietary fiber—can lower blood cholesterol and blood LDL-cholesterol, and, at the same time, improve the quality of triglyceride (TG) circulating around in the blood. More specifically, inclusion of chicken can increase the omega-3 content of the TGs and lower their content of arachidonic acid (AA). Since omega-3s are considered to be anti-inflammatory fatty acids, and since AA is considered to be a pro-inflammatory fatty acid, this change in the composition of the TGs with chicken consumption could be considered as providing anti-inflammatory benefits to the cardiovascular system.

Other Potential Health Benefits

Many people wonder about the potential health advantages of switching from beef to chicken, especially in the context of colon cancer risk. A first important piece of information to remember in this context is that studies on beef consumption and colon cancer typically find increased risk from high consumption (5 or more ounces per day). We're not aware of any research showing increased colon cancer risk from consumption of 3-4 ounces of beef several times per week. At this higher intake level, however, the increased risk of colon cancer associated with beef does not appear to be associated with chicken. In a recent study analyzing risk of colorectal cancer in more than 20 studies involving chicken, turkey, and fish, researchers found was no evidence of increased colorectal cancer risk, even when chicken was consumed four to five times per week. In addition, as chicken intake increased on an ounce-by-ounce basis from a very small amount (less than one ounce per week) to 4-plus ounces per week, risk of colorectal cancer was not found to increase.

It is possible to increase the omega-3 content of chicken meat—including both light and dark meat, as well as chicken skin—by feeding chickens supplemental amounts of fish meal or fish oil.

Regardless of the amount of chicken you choose to include in your meal plan, we recommend certified organic chicken that has been genuinely pasture raised. By "genuinely," we mean that it is often important to go beyond the labeling claims of "pastured" or "pasture-raised" or "free range" and ask the grocer or the chicken producer about the actual lifestyle circumstances for the chickens.

Description

Chickens belong to the bird class of animals (*Aves*), and all breeds of chicken come from the same genus, species, and subspecies of bird (*Gallus gallus domesticus*). However, within this subspecies, there are many different breeds.

When chickens are raised for meat, they are typically referred to as either "broilers" (also called "fryers") or "roasters." Fryers and broilers are usually bred for rapid growth and may reach a weight of four to five pounds in as few as five weeks and may be slaughtered as early as five weeks of age. Roasters are typically fed for a longer period of time (12 to 20 weeks) and are not slaughtered until they reach greater weights of six to 10 pounds. When not being raised for food, the natural lifespan of chickens is approximately five to 10 years, although some chickens can live much longer.

Popular breeds for broiler chickens include Cornish, White Rock, Hubbard, Barred, Cornish Cross, and Cornish Rock. There are fewer breed choices for broilers than for layers. (Among the many breeds available for egg laying are White Leghorns, Rhode Island Reds, Buff Orpingtons, Golden Coments, Red Sex Links, Isa Browns, Australorps, Black Star, Red Star, Light Sussex, and Plymouth Rock.)

While chickens are not the only birds consumed for food, they are the most commonly eaten birds in commercial food supplies. Other birds consumed for food include ducks, geese, quail, turkeys, and ostriches.

You will sometimes hear the word "fowl" being used to refer to chickens. Fowl is a broad term that includes all species within the *Gallus* genus of birds. The word "poultry" usually refers to any fowl that have been domesticated.

While we recommend all of our dairy products in grass-fed form (including grass-fed beef, cheese, milk, and yogurt), we cannot include chicken in this grass-fed category because chickens are not herbivores but rather omnivores. Unlike cows, who only eat plant foods and who have a special ruminant digestive system for getting optimal nourishment from grasses, chickens enjoy eating a wide variety of non-plant foods including, grubs, worms, and insects. While many chickens do enjoy grass, they still do not depend on it in their natural diet in the same way as cows. In natural pasture settings, chickens can typically find all of their naturally preferred foods, including many kinds of seeds, insects, clovers, grasses, and other vegetation. For this reason, we believe that "pasture-raised" best describes the lifestyle quality that is optimal for chickens.

History

Although the practice of domesticating fowl dates back at least as far as 2,000 BC, the raising of chickens—for food, for eggs, or simply as pets—seems to have fluctuated throughout human history. At times, both chicken eggs and chicken meat were considered as luxury foods, while at other times, these same foods have been considered as everyday staple foods.

In the U.S., "backyard chickens" have fluctuated similarly in popularity. At present, approximately 150,000 - 200,000 households in the U.S. are estimated to raise small numbers of chickens on their family property. Dozens of cities across the country have recently updated or passed new laws or ordinances for "urban chickens," with many cities setting a cap at five or six chickens per family and their residing a minimum distance of 25-50 feet away from neighboring houses.

Commercial production of chicken in the U.S. has grown continuously and dramatically over the past 30 years. In 2010, production of broiler chickens surpassed 35 billion pounds and is expected to surpass 40 billion pounds by 2020. Per capita chicken consumption was approximately 50 pounds per year in 1985 but had grown to nearly 85 pounds per year by 2005. Today that per capita consumption is down slightly to about 75 pounds, but it is expected to return to the 80-pound level by 2020. Consumption of chicken presently exceeds consumption of beef by approximately 35%.

The United States is the world's largest producer of broiler chicken, and among the U.S. states, Georgia, Arkansas, Alabama, Mississippi, and North Carolina produce the most chicken for meat purposes. (In terms of egg-laying flocks, Iowa, Ohio, Pennsylvania, Indiana, and Texas are states with the most chicken production.)

How to Select and Store

When purchasing whole chickens, look for ones that have a solid and plump shape with a rounded breast. Whether purchasing a whole chicken or chicken parts, the chicken should feel pliable when gently pressed, and it should not have an "off" smell. Do not buy chicken if the sell-by date on the label has already expired.

The color of the chicken's skin, white or yellow, does not have any bearing on its nutritional value. Regardless of color, the skin should be opaque and not spotted.

If purchasing frozen chicken, make sure that it is frozen solid and does not have any ice deposits or freezer burn. Additionally, avoid frozen chicken that has frozen liquid in the package as this may indicate that it has been defrosted and refrozen.

As described earlier in this article, we recommend certified organic chicken; in addition to this standard, we also recommend chicken that has been pasture-raised. The reason for this recommendation involves some unreliable standards with respect to the pasture raising of organic chicken.

Yet, unfortunately, while it's important to look for chicken that have been pasture-raised you need to do a little extra work to really find them. That's because of the misleading nature of labeling terms like "pastured," "pasture-raised," "free-range," or "cage-free."

Unfortunately, while legal, these labeling terms are also misleading. The term "free-range," for example, means that the hens that lay the eggs must have access to the outdoors - but the emphasis here is on "access." No standards are set for how often the hens actually go outside, how much time they must stay outside if they do go out, or what the outdoor environment must include in terms of total space or vegetation. "Pastured" and "pasture-raised" are similarly misleading terms that are not backed up by standards for actual time spent by hens in a pasture setting or standards for qualifying an outdoor space as "pasture." Use of the term "cage-free" on the label of an egg carton means what it says - but legal use of this term does not require hens to have any access to outdoor space and therefore may be used when hens have been confined indoors full-time.

With respect to organic standards, no minimal amount of days spent outdoors or time per day spent outdoors is required for production of organic chicken. Nor must any minimal amount of chicken feed be obtained from a pasture setting. In fact, standards for the pasture setting are not adequately addressed in organic chicken standards. Organic standards require strict feeding with certified organic feed, but legal use of the organic label does not require any fixed amount of feed to be obtained from a pasture setting.

So organic does assure you of higher quality feed for chickens and other desirable production conditions. However, just like the other labeling terms listed above, organic still does not assure you of chicken that has been pasture-raised. The basic issues involved with pasture-raised are not complicated. It isn't enough to provide chickens with "access" to the "outdoors"—they need regular time (usually daily) actually spent pecking, foraging, roaming around, and interacting socially in a setting with natural vegetation, insects, worms, grubs, shade, and sunlight. We suggest that you talk with your grocer and/or directly with your chicken producer to find out if these circumstances were provided for their chickens.

We think that the best strategy for enjoying the most flavorful and lowest fat form of chicken is *not* to purchase already skinned chicken breasts. Rather, purchase chicken breasts with the skin still intact, waiting to remove the skin until after cooking (In this way you'll improve the moisture and flavor and aroma of your chicken, while not significantly increasing the total fat content.)

Chicken should be stored in the coldest section of your refrigerator. If the store packaging is intact and secure, store it this way since this will reduce the amount of handling. Yet, if the packaging is not secure, and it seems as if the chicken liquids will leak, rewrap it securely before storing. This is very important to make sure that the chicken does not contaminate other foods in the refrigerator. Refrigerated raw chicken can keep for two to three days.

To freeze chicken, remove it from its packaging, wash it and then pat it dry. Using either aluminum foil or freezer paper, wrap the chicken parts carefully so that they are as airtight as possible. Well-wrapped frozen chicken can keep for about one year.

Many people wonder about the differences between dark meat and light meat, and how to decide which to select. We've created a table, which we included in the Health Benefits section (see above), to help explain how dark meat (in the form of a chicken leg) and light meat (in the form of a chicken breast) differ in terms of their fat-related content.

From a calorie standpoint, most people would have room for any 175-200 calorie, moderately sized (100 grams, or about 3.5 ounces) portion of chicken, regardless of its light/dark or skin/skinless quality. However, for anyone wanting to minimize their intake of animal fat, skinned chicken breast would make the most sense with less than 4 grams of total fat and only 1 gram of saturated fat. If the chicken you eat is both organic and pasture-raised, there are going to be valuable nutrients in both dark meat and light meat, and there are also going to be valuable nutrients in the skin. (The skin contains many of the same vitamins and minerals as the flesh, and a greater concentration of some fat-soluble vitamins like the retinol form of vitamin A.) The choice of light versus dark and skin-included or skin-removed is a choice that should be made in the context of your overall meal plan, how much room you have in your meal plan for fat-related nutrients including saturated fat, total fat, and cholesterol, and of course your taste preferences.

How to Enjoy

A Few Quick Serving Ideas

- Chicken salad can be prepared numerous ways and can be served for lunch or dinner. One of our favorite recipes is to combine the chicken with fresh lemon juice, and olive oil, and mix in garden peas, leeks, almonds and raisins.
- For a quick meal with an Asian flair, Healthy Sautée chopped chicken breast with your favorite vegetables. Add soy sauce, sesame seeds, ginger, garlic and/or the seasonings of your choice.
- Add pieces of diced chicken breast to white bean chili to rev up its protein and nutritional content.
- Wrap cooked chicken pieces in a whole wheat tortilla, sprinkle with chopped tomatoes and onions, top with grated cheese and broil, making yourself a healthy burrito.

For some of our favorite recipes, click Recipes.

Safety

Risk of Bacterial Contamination

Raw chicken meat—including conventional, organic, and pasture-raised—often contains measurable populations of potentially problematic bacteria, including *Campylobacter*, *Enterococcus*, *Listeria*, and *Salmonella*. Studies by the Food Safety and Inspection Service (FSIS) at the U.S. Department of Agriculture have shown that approximately one out of eight broiler chicken samples are contaminated with *Salmonella*, even though only 20% of these contaminated samples contain the most potentially problematic species of *Salmonella*, namely, *Salmonella enteriditis (SE)*. Despite these relatively high rates of contamination, however, there have been surprisingly few SE-related recalls for chicken meat, especially in comparison to the large number of recalls for both chicken eggs and beef.

With respect to eggs, many cases of exposure have involved raw or minimally cooked egg products, and we suspect that the smaller number of chicken meat recalls is related to the lower likelihood of undercooked chicken meat in restaurants and homes. While consumers often like minimally cooked eggs (or even raw eggs), they seldom prefer undercooked or raw chicken meat.

If you decide to include chicken in your meal plan, the best way to address these contamination concerns is to use the utmost care in handling and storing chicken and to fully cook chicken before you consume it. For more details on proper handling and storing, please see our How to Select and Store and Tips for Preparing and Cooking sections. With respect to complete cooking of chicken meat, an internal temperature of 165°F (74°C) is required. A meat thermometer is your best way to determine if this cooking temperature has been reached.

Humane Treatment of Chickens

An increasing number of consumers have raised questions about the quality of life for both broiler and egg-laying chickens, and a variety of different third-party animal welfare organizations have started to offer certification for chicken producers who would like to display some label on their packaging that address animal welfare issues. In general animal welfare and humane treatment issues include

- quality of the indoor environment
- access to the outdoors
- quality of the outdoor environment
- quality of the food supply
- naturalness of the food supply
- role of forced molting
- role of beak trimming and debeaking
- flock size
- exposure to natural day/night cycles
- transport standards
- quality of slaughter methods

Slaughter, in particular, has been an area of special concern and remains an area of ongoing debate with respect to organic chicken regulations. For example, current organic regulations do not specify a limit for the time chicken can be kept at a slaughter facility, a limit on shackle time, or verification of stunning pre-scalding. One further much-debated slaughter-related issue has involved the role of electrical immobilization versus "controlled atmosphere killing" (CAK).

Unfortunately, current labeling and certification standards do not provide any easy way to assure humane treatment of chickens when purchasing chicken. Like assurance of pasture-raising, assurance of humane treatment is an issue that will require you to follow-up with your grocer or directly with the chicken producer.

Other Controversies

Some animal foods and some plants foods have been the subject of ongoing controversy that extends well beyond the scope of food, nutrient-richness, and personal health. This controversy often involves environmental issues, or issues related to the natural lifestyle of animals or to the native habitat for plants. Chicken has been a topic of ongoing controversy in this regard. Our Controversial Foods Q & A will provide you with more detailed information about these issues.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Chicken, pasture-raised, breast, roasted
4.00 oz
113.40 grams

Calories: 187
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin B3	15.55 mg	97	9.3	excellent
protein	35.18 g	70	6.8	very good
selenium	31.30 mcg	57	5.5	very good
vitamin B6	0.68 mg	40	3.8	very good
phosphorus	258.55 mg	37	3.6	very good
choline	96.73 mg	23	2.2	good
pantothenic acid	1.09 mg	22	2.1	good
vitamin B12	0.39 mcg	16	1.6	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Lamb, grass-fed

Shopping for Lamb	
Stick with organic	Organic standards help lower risk of contaminated feed and organic lamb usually has higher nutrient quality. However, remember that organic by itself does not guarantee a natural lifestyle for the lambs.
Ask for 100% grass-fed	Go beyond organic by asking for 100% grass-fed. Don't get sidetracked by the confusing array of labeling terms like natural" or "pasture-raised." Labeling laws allow products to display these terms even if lambs spend little or no time outdoors in a pasture setting. Unfortunately, even the term "grass-fed" is not sufficient since grass-fed lambs may have spent a relatively small amount of time grass feeding. The standard to look for on the label is "100% grass-fed." Talk to your grocer or the lamb farmer and find out how the animals were actually raised. In addition, if you would like more information about the practice of grass-feeding, please click here.
Consider local farms	Organic, 100% grass-fed lamb may be available from local farms with small flocks, which provide a natural lifestyle for their lambs. Two websites that can help you find small local farms in your area are www.localharvest.org and www.eatwild.com. Both sites are searchable by zip code.

What's New and Beneficial about Lamb

- When we think about omega-3 fats and their availability from plants versus animals, we usually think about nuts and seeds on the plant side of things and fish on the animal side. But on the animal side of things, we should also think about grass-fed lamb! The omega-3 content of lamb depends upon the young sheep's diet as well as the mother's diet, but when those diets are nutritionally supportive, the result can be a cut of lamb with an impressive amount of omega-3s. In regions of some countries without access to a coastline and fish, lamb has sometimes been shown to provide more omega-3s than any other food in the diet. In Australia, where lamb is eaten frequently by both children and adults, recent studies have shown lamb to rank among the top omega-3 foods in the daily diet. Grass-fed lamb has been shown to average at least 25% more omega-3s than conventionally fed lamb, including as much as 49% more ALA (alpha-linolenic acid, the basic building block for omega-3s). In our own nutritional profile of grass-fed lamb, we use a conservative average estimate of 40 milligrams of omega-3s per ounce of roasted lamb loin. That's 50% of the omega-3s in an ounce of baked cod fish or broiled tuna, and 67% of the amount in an ounce of sesame seeds.

- Conjugated linoleic acid (CLA) is a health supportive omega-6 fatty acid that has surprised researchers in terms of its health benefits. Since the average U.S. adult consumes too many omega-6 fatty acids in relationship to omega-3s, research studies often fail to show health benefits for increased amounts of individual omega-6 fatty acids. In addition, CLA is not only an omega-6 fatty acid but also a trans fatty acid. As a general rule, it is best to keep your intake of trans fats as low as possible. Yet, CLA appears to be an exception to the rule about omega-6s and trans fat because an ever-increasing number of studies show increased intake of CLA to be associated with improved immune and inflammatory function, improved bone mass, improved blood sugar regulation, reduced body fat, and better maintenance of lean body mass. Recent studies show that grass-fed lamb contains nearly twice as much CLA as conventionally fed lamb. Interestingly, lambs grazing during the spring and summer months store more CLA than lambs grazing during the fall and winter; higher CLA storage is also found for lambs grazing on highland and mountain pastures. Studies have also shown intake of fresh pasture grasses to be associated with significantly more CLA in lamb than feeding of the same grasses in dried form. In our nutrient profile for grass-fed lamb, we use a very conservative estimate of CLA of 25 milligrams in 4 ounces. We've seen some studies showing two to seven times this amount, depending on the specific feeding and lifestyle circumstances.

- Several recent studies show that overall fat levels in lamb can be reduced through the practice of grass feeding. This reduction in overall fat content has also been shown to be particularly apparent in loin cuts of lamb. Even though the average daily weight gain in conventionally fed versus grass-fed lambs has been shown to be similar in these studies, the foraging process has been shown to lower total fat content by a minimum of approximately 15%. This finding makes good sense to us. Lambs out in pasture are more active than lambs kept indoors, and this greater level of activity is likely to have the animals develop more muscle and burn more calories as well. In addition, lambs out in pasture are likely to eat less. Unlike lambs kept indoors and fed concentrate, lambs grazing outdoors are more likely to get involved in other activities and be less focused on feeding regimens.

Lamb, grass-fed, lean loin, roasted
4.00 oz

(113.40 grams)

Calories: 310
GI: very low

Nutrient	DRI/DV
vitamin B12	105%
protein	51%
selenium	51%
vitamin B3	50%
zinc	35%
phosphorus	29%

Health Benefits

Because lamb has received much less attention in the research literature than its fellow ruminant meat—namely, beef—we have been unable to find large-scale research studies on humans that analyze lamb intake and its relationship to disease. Another factor involved with the absence of health research on lamb within the U.S. has been the very limited consumption of lamb by U.S. adults (less than one pound per year).

When smaller scale studies of food and health have included lamb, this food has traditionally been lumped together within a category called "red meats," and the meats examined in these smaller studies have typically come from conventionally fed animals. Because grass feeding improves the nutritional value of both beef and lamb, and because lambs are smaller ruminants than cows with different physical characteristics, we would expect studies of grass-fed lamb to show unique results and some unique health benefits.

Potential Support for Heart Health

The first area of expected health benefits involves cardiovascular diseases. Our reasons for expected specific health benefits in this area are as follows:

- Lamb is commonly included as a meat consumed in Mediterranean diets, which have repeatedly been shown to help lower risk of cardiovascular disease.
- Grass-fed lamb is a significant source of omega-3 fats, whose adequacy in the diet is associated with decreased risk of inflammation and heart disease. In addition, the ratio of omega-3 to omega-6 fats is far better in grass-fed lamb than in the average U.S. diet. When omega-3 to omega-6 ratios are improved in research studies on human diets, risk of cardiovascular diseases has been show to decrease.
- Conjugated linoleic acid (CLA) is found in valuable amounts in grass-fed lamb. Increased intake of this nutrient is associated with reduced inflammation and reduced body fat. Both of these consequences would be expected to lower heart disease risk.
- About 40% of the fat in grass-fed lamb come from oleic acid, a monounsaturated fat. This type of fat (for which extra-virgin olive oil is lauded) is generally associated with decreased risk of heart disease.
- Grass-fed lamb is a very good source of selenium and a good source of zinc. Healthy intake of these antioxidant minerals is a protective factor against oxidative stress and development of heart disease.
- Lamb is an excellent source of vitamin B12 and a very good source of niacin. It also provides important amounts of the B vitamins B1, B2, B6, folate, biotin, pantothenic acid, and choline. Vitamins B6, B12, folate, and choline are especially important for healthy metabolism of homocysteine and can help prevent unwanted accumulation of excess homocysteine in the body. High blood levels of homocysteine are a key risk factor for cardiovascular disease.

Additional Potential Health Benefits

A second area where we would expect to see health benefits from lamb consumption would involve blood sugar regulation. Lamb has long been a part of menus and recipes endorsed by the American Diabetic Association, who view it as a lean meat that is high in protein and one which can be beneficially incorporated into recipes in amounts of three to four ounces per serving. Lamb is often unranked on lists of glycemic index (GI) values due to its virtually non-existent carb content. This absence of carbs in lamb might allow the very broad B-vitamin content of lamb to help support metabolism of other carbs provided by other foods that were consumed alongside of the lamb. (Vitamins B1, B2 and B3 are especially important in the optimal functioning of enzymes in carbohydrate metabolism.)

Description

Americans eat a fraction of the amount of lamb consumed in many other countries in the world. That's too bad since this red meat is very healthful and extremely delicious, having a very tender and buttery quality. Lamb is the meat from young sheep that are less than one year old. It is usually available in five different cuts including the shoulder, rack, shank/breast, loin, and leg.

"Rack of lamb" usually refers to a rib cut that includes nine ribs and can be split into rib roasts. Lamb "chops" can come from several different cuts. For example, "rib chops" come from the rib and "loin chops" come from the loin. You might also see "blade" and "arm" chops in the meat section of the grocery; those chops come from the shoulder. Sirloin chops are another type of chop that you might see; these come from the leg. Additionally, many stores sell lamb that has already ground and which is used to make burgers, meat loaf, or sauces.

Lamb belongs to the group of mammals known as ruminants that have unique digestive systems that enable them to stay healthy on a diet of grasses and forage plants. More specifically, lamb belongs to the special group of ruminants that are cloven-hoofed. This group is often referred to as the "bovid" group since the scientific name for its family is the Bovidae. Alongside of lamb, the bovids include bison, buffalo, antelope, gazelle, goats, and domestic cattle. The word "lamb" refers to meat from a baby sheep that was less than 12 months in age prior to slaughter. (Meat from adult sheep is called "mutton.") Many lambs are brought to slaughter earlier, however, and often between six and eight months of age. The genus and species for lamb is *Ovis aries*.

Lambs are initially nursed by their mothers until weaning, and studies have shown that the quality of the mother's diet plays an important role in the eventual nutrient quality of the lamb. Grass feeding by the mother provides nutritional benefits for the nursing lamb as well as for humans who eventually consume the lamb meat. When young lambs are weaned from their mother's milk and begin consuming solid foods, research once again shows that feeding in pasture provides the best nutritional option for the lambs. Conventionally raised lambs do not usually experience either of these (nursing from a mother who grazes on pasture, or grazing on pasture themselves after weaning.) Both of these factors enter into our recommendation of 100% grass-fed lamb.

History

Sheep were among the first animals ever to be domesticated by humans, occurring more than 10,000 years ago. The domestication of sheep most likely started out in the Middle East, in what is now Turkey. As a source of not only food but also textiles (wool), sheep were introduced and became popular throughout many regions of the world. The Romans introduced sheep into Great Britain, where lamb remains very popular, over 2,000 years ago. Lamb was not introduced into the Western Hemisphere until the early 16th century when the armies of the Spanish explorer Hernán Cortés brought sheep with them on their explorations.

What was most prized by early civilizations was not the meat obtainable from sheep but rather their wool. In Babylonia, Sumaria, and Persia, the raising of sheep for their fleece became an important industry to such an extent that flocks of sheep were used as the medium of exchange between countries engaging in barter. In Greek mythology, fleece from sheep—known as "the gold-haired winged ram"—played a pivotal role in the myth of Jason and the Argonauts, as the quest for it related to Jason proving his worthiness of kingship to King Pelias. Since ancient times, lamb has been regarded as a religious symbol. It was commonly used as a sacrifice, and a symbol of sacrifice, in many religions including Judaism. In many countries, lamb is a traditional dish at Easter in commemoration of the Last Supper at which lamb was likely served. Jesus is often referred to as the "Lamb of God."

Lamb is a staple in cuisines throughout the world including Turkey, Greece, New Zealand, Australia, Africa, and countries of the Middle East. In the U.S., per capita consumption of lamb is much lower than in the rest of the world, averaging 14 ounces per year. By contrast, world consumption averages 4 pounds per person, African consumption averages 5.5 pounds per person, and consumption in Australia and New Zealand averages 25 pounds per person.

Lamb farming reached its peak in the U.S. in 1884 with 51 million head of sheep. Today, lamb farming involves about 6 million head. The U.S. produced about 161 million pounds of lamb and mutton in 2011 (as compared with 50 billion pounds of all red meats, including veal, beef, and pork). Australia, with 70 million head of sheep, and New Zealand, with 32 million head, export more lamb than any other countries. In 2011, for example, these two countries combined exported nearly 1.4 billion pounds of lamb. Half of all lamb consumed in the U.S. is imported, and within this category of imported lamb, nearly 68% comes from Australia and 30% from New Zealand.

How to Select and Store

The U.S. Department of Agriculture (USDA) requires inspection of lamb for overall wholesomeness. However, grading of lamb is voluntary, and not all cuts of lamb in the grocery will carry a USDA Grade. The USDA currently authorizes five grades for lamb, including prime, choice, good, utility, and cull. Prime and choice are usually the only grades that you will find in the supermarket. Prime and choice grades of lamb are similar in terms of tenderness and juiciness, and are higher in fat than the lower three grades. If you want to lower your total fat intake while including lamb on a regular basis in your diet, you may want to choose lamb that's been graded as "choice" over lamb that's been graded as "prime" since choice lamb does have slightly lower marbling (and total fat content) than prime lamb.

Although lamb is generally a very tender meat, there are still signs you can look for to better ensure high quality. Purchase lamb whose flesh is firm, fine textured and pink in color. Any fat surrounding or marbled throughout the lamb should be white, not yellow. Of course, we always recommend 100% grass-fed lamb regardless of the grade or cut.

"Spring lamb" is label that used to be helpful in determining a particular type of lamb; yet now it has come to be as confusing as it is helpful. Originally, "spring lamb" was a description used for breeds of sheep that gave birth in the late fall, nursed newborns through the winter, and moved out to pasture in early spring. Over time, the term "spring lamb" also started to be used for lambs that were born in the spring and raised during summer and early fall. To make matters even more complicated, lengthened breeding seasons and more flexible pasture options have expanded the time of availability for fresh lamb, and the term "spring lamb" is now sometimes used when there is no unique relationship between spring and the animal's upbringing! In many cases, "spring lamb" is a term that does still apply to locally grown lamb that has pastured in early spring and goes to market in spring or summer, often at local farmer's markets.

Since lamb is highly perishable, it should always be kept at cold temperatures, either refrigerated or frozen. After purchasing lamb, you'll want to get it home as soon as possible and refrigerate it immediately at 40°F/4°C or below. Refrigerate the lamb in the original store packaging, if it is still intact and secure, to reduce the amount of handling involved. If the lamb has a "Use-By" date, follow that for guidelines as to how long it will stay fresh. If it does not, then follow these simple guidelines: lamb roasts and chops can stay fresh in the refrigerator three to five days while ground lamb will only stay fresh for up to two days.

If you have more lamb than you can use within this period of time, you can freeze it. Using freezer paper or plastic freezer wrap, wrap the lamb carefully so that it is as tightly packaged as possible. If you plan to freeze for one week or longer, it's a good idea to overwrap it with a second layer or place the already-wrapped lamb into a freezer bag to prevent freezer burn. Ground lamb should be able to keep for three to four months while roasts and chops will keep for about six to nine months.

How to Enjoy

A Few Quick Serving Ideas

- Ground lamb makes delicious burgers. Season and cook as you would a hamburger.
- Braise lamb loin pieces in red wine, garlic and rosemary.
- The hearty flavor of lamb makes it a wonderful meat to be featured in a stew.
- For a healthy twist on the traditional food pairing, serve lamb with a mint yogurt sauce, made from plain yogurt, mint leaves, garlic, and cayenne.
- Place bite-size pieces of lamb on a skewer with your favorite grilling vegetables and make lamb shish kebobs.
- Serve grilled lamb with green beans or ratatouille.

WHFoods Recipes That Feature Lamb

- Healthy Breakfast Frittata
- 10-Minute Rosemary Lamb Chops
- Indian Style Lamb with Sweet Potatoes
- Roast Leg of Lamb

Safety

Other Controversies

Some animal foods and some plants foods have been the subject of ongoing controversy that extends well beyond the scope of food, nutrient-richness, and personal health. This controversy often involves environmental issues, or issues related to the natural lifestyle of animals or to the native habitat for plants. Lamb has been a topic of ongoing controversy in this regard. Our Controversial Foods Q & A will provide you with more detailed information about these issues.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Lamb, grass-fed, lean loin, roasted
4.00 oz
113.40 grams

Calories: 310
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin B12	2.51 mcg	105	6.1	excellent
protein	25.57 g	51	3.0	very good
selenium	27.90 mcg	51	2.9	very good
vitamin B3	8.05 mg	50	2.9	very good
zinc	3.87 mg	35	2.0	good
phosphorus	204.12 mg	29	1.7	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Turkey, pasture-raised

Shopping for Turkey	
Stick with organic	Organic standards help lower risk of contaminated feed and organic turkey usually has higher nutrient quality. However, remember that organic by itself does not guarantee a natural lifestyle for the turkeys.
Ask for pasture-raised	Go beyond organic by asking for pasture-raised. Don't get sidetracked by the confusing array of labeling terms. You are likely to find phrases like "pasture-raised," "pastured," "free-range" and "cage-free" on turkey meat packaging, but labeling laws allow products to display these terms even if the turkeys spend little or no time outdoors in a pasture setting. Talk to your grocer or the turkey farmer and find out how the animals were actually raised.
Consider local farms	Organic, pasture-raised turkey may be available from local farms with small flocks and a natural lifestyle for their turkeys. Two websites that can help you find small local farms in your area are www.localharvest.org and www.eatwild.com. Both sites are searchable by zip code.

What's New and Beneficial about Turkey

- With ample time spent foraging in a pasture with natural and mixed vegetation, it is very likely that the omega-3 content of turkey meat can be increased and that the ratio of omega-6 to omega-3 fats can be improved. Several recent studies have examined the diets of turkeys (and chickens) who regularly spent time in pastures with leguminous plants like clovers and vetch. These pasture-based diets were found to increase the level of omega-3s in turkey meat and also to lower the ratio of omega-6s to omega-3s. While the overall ratio of omega-6:omega-3 in conventionally fed turkey meat averages approximately 10:1 or higher, this same ratio was lowered to approximately 7:1 as a result of pasture feeding. For reasons involving nutrient balance and nutrient interactions, we definitely prefer natural pasture feeding of turkeys as a way to improve their health and fat quality instead of supplementation of their diets with omega-3 containing oils (like linseed oil). However, it's worth noting that several recent studies have also shown the ability of omega-3 containing, oil-supplemented diets to increase omega-3s in turkey meat and to lower omega-6:omega-3 ratios. These supplementation studies tell us that turkeys are indeed sensitive to their dietary intake with respect to omega-3s and that this sensitivity shows up in the composition of turkey meat.
- Turkey (together with chicken) has emerged as a food associated with decreased pancreatic cancer risk - provided that it is consumed in skinless form. A recent study has shown that turkey—when consumed in amounts of 1 to 4 ounces per day or more—is associated with decreased risk of pancreatic cancer when it is eaten with the skin removed. (In this study, if the turkey skin was consumed along with the meat, the risk of pancreatic cancer stayed steady, not going up or down.) There same results were not true for beef, which was associated with slightly increased pancreatic cancer risk. It's worth noting that pasture-raised poultry and grass-fed beef were not standards used in this study. We would expect the risk-lowering benefits of all meats to be increased if study participants consumed grass-fed and pasture-raised foods.
- Turkey has recently been shown to fall into a group of high-protein foods (including tuna and egg whites) that can help keep post-meal insulin levels within a desirable range. The common link found between these foods is protein richness. Four ounces of skinned turkey breast will provide 30-35 grams of protein, with less than 1 gram of total fat. Four ounces of white tuna canned in water (the version used in the research) provide 26 grams of protein and only 2 grams of total fat. Four ounces of egg whites provide 12 grams of protein and 0.2 grams of fat. The rich amount of protein contained in these foods was enough to help stabilize and regulate meal digestion, and in so doing, it helped stabilize insulin levels as well. Given these three foods that were analyzed in the research, we definitely like turkey best. Pasture-raised, organic turkey is a food that we would consider whole and natural, unlike egg whites, which we would only consider to be part of a whole food. As for tuna, while it can clearly qualify as a whole, natural food, we would recommend the fresh versus processed version and we would also caution about consumption of white albacore tuna, which can often be higher in mercury content than other types of tuna. In addition, as the numbers make clear, the most protein-rich of these three foods is skinned turkey breast.

Turkey, pasture-raised, light meat, roasted
4.00 oz
(113.40 grams)

Calories: 167
GI: very low

Nutrient	DRI/DV
vitamin B3	83%
protein	68%
selenium	62%
vitamin B6	54%

phosphorus	37%
choline	22%
pantothenic acid	20%
vitamin B2	18%
zinc	18%
vitamin B12	18%

Health Benefits

Broad Nutrient Support

Because most cuts of turkey provide valuable amounts of protein, turkey is often regarded as a high-protein food. Skinned turkey breast will provide the most protein per serving, at 34 grams in 4 ounces. But you will still get 31 grams from 4 ounces of turkey leg and 21 grams from 4 ounces of turkey thigh.

In addition to protein, however, turkey is also rich in other nutrients. All B vitamins are present in turkey meat, including B1, B2, B3, B5, B6, B12, folate, biotin, and choline. (Because the biotin content of turkey meat is sensitive to the turkey's dietary intake, the amount of this vitamin can vary greatly, with an approximate average of 0.8 micrograms in 4 ounces of turkey breast.) Turkey is an excellent for vitamin B3 (niacin) and provides over 13 milligram in 4 ounces, or over 80% of the Dietary Reference Intake (DRI). It's also a very good source of vitamin B6, at 0.92 milligrams in 4 ounces (54% DRI). By providing 22% DRI for choline in 4 ounces, turkey also ranks as a good source of this B vitamin.

In terms of minerals, turkey is richest in selenium and provides over 60% of the DRI in a single 4-ounce serving. Zinc, copper, phosphorus, magnesium, potassium, and iron are also provided by this food in noteworthy amounts.

All cuts of turkey contain omega-3 fats. However, the content of omega-3s in turkey can vary widely, depending on the turkey's diet. One of the reasons we recommend pasture-raised turkey is the ability of turkeys to enjoy omega-3 containing plants and insects in natural pasture settings. As a general rule, the most favorable ratio of omega-6 to omega-3 fats is found in skinned turkey breast, where the ratio in non-pasture-raised turkey is approximately 10:1. This same ratio is about 13:1 in non-pasture-raised turkey leg or turkey thigh with skin. While there are only a few studies documenting the omega-6 to omega-3 ratio in pasture-raised turkey, those studies suggest that pasture feeding can lower the ratio to approximately 7:1. (There are some studies on pasture-raised chickens that show similar results.) Within the omega-3 family of fats, it is possible to get 10-60 milligrams of DHA (docosahexaenoic acid) from a 4-ounce serving of turkey, depending on the cut and diet consumed by the turkey. DHA is a unique omega-3 fat in terms of its ability to support healthy nerve function.

Protein Richness

When we rank all of our 100+ WHFoods based on their protein richness (how much protein they provide in comparison with their calorie content), turkey ranks third among all of our foods. A 4-ounce serving of skinned baked turkey breast provides about 34 grams of protein and over two-thirds of the Daily Value (DV). With 4 ounces of turkey leg, this number drops just slightly to 31-32 grams of protein. With 4 ounces of turkey thigh, it drops to about 21 grams. In these examples, the protein values are changing from cut-to-cut partly because of the way the turkey moves and uses its muscles, and partly because of the fat content of the various cuts. If the health benefit you are seeking from turkey is focused on protein richness, you'll probably want to stick with skinned turkey breast as your preferred cut.

Other Health Benefits

Unfortunately, there is not as much research on turkey as there is on chicken, its fellow bird in the poultry category. Several preliminary studies show the protein richness of turkey to be of potential benefit in regulating blood sugar levels as well as insulin metabolism. These findings make sense to us since adequate protein intake in a balanced way throughout the day can be very helpful in managing blood sugar. In the area of cancer prevention, the studies that we have seen on turkey mostly differentiate it from red meat (mostly beef) and show that intake of turkey is not associated with increased cancer risk in the same way as red meats. However, these studies do not usually go on to show that turkey intake *lowers* risk of cancer—they simply show that turkey intake does not raise this risk. An additional problem in this area is the lack of studies on pasture-raised turkey. We have not found any studies on pasture-raised turkeys and cancer risk. We very much look forward to future research in which this important topic is addressed.

Description

Like chicken, turkey belongs to the bird (*Aves*) class of animals, and to the family of birds called *Phasianidae*. While there are many different breeds of turkeys, most of them belong to the same genus and species of bird, namely *Meleagris gallopavo*. Turkeys are truly native to North and South America - they were not brought to the "New World" by European settlers but were instead discovered to be already present and intimately involved with Native American cultures. Turkeys are relatively large birds that can reach about 30-35 pounds in weight. They can fly short distances at speeds of about 50-55 miles per hour and run at approximately 20-25 miles per hour.

When provided with natural pasture, turkeys will spend extensive time foraging. They are very diverse in their food selection! Pasture-raised turkey enjoy eating acorns, beechnuts, pine seeds, grasses, grass seeds, sedges, farbs, tubers, bulbs, crabgrass, wild berries, alfalfa, clovers, beetles, grasshoppers, and leafhoppers. This very broad natural diet is one of the reasons that we recommend pasture-raised turkey.

"Poults" is the name often used for young turkeys (and other young fowl). Female turkeys are called hens, and male turkeys are called toms or gobblers. In their first weeks of life, poults are typically kept in a brooder area that is temperature controlled (often 90-100°F) and may have limited pasture depending on the exact circumstances with the flock and habitat safety.

Many different breeds of turkey are pasture-raised for food. These breeds include Broad-breasted Whites, Standard Bronze, White Holland, Bourbon Reds, Narragansetts, and Royal Palm.

History

As mentioned in the Description section, turkeys are truly native to North and South America and were an important part of Native American cultures long before the arrival of the European colonists. While Native American cultures did domesticate numerous breeds of turkeys, other breeds remained wild and were hunted in woodlands instead of domesticated. However, from fossil evidence and DNA analysis, we do know that turkeys were indeed domesticated in Mesoamerica (Mexico and Central America) prior to the arrival of the European colonists. They were domesticated once again by the Spanish and British who eventually brought them back to Europe and introduced them into the food supplies of their homelands.

At 2.5 million tons of turkey meat per year, the U.S. is by far the world's largest producer of turkey. (All countries in the European Union combined produce 1.75 million tons.) Smaller amounts of turkey are produced in Africa, Asia, and the Mediterranean. At about 450,000 tons, Brazil is the largest turkey producer in South America.

In the U.S., we consume an average of 16.5 pounds of turkey per person per year. That about is about one-quarter of our chicken consumption. According to the National Turkey Federation, about 20% of all turkey (just over three pounds per person) is consumed on Thanksgiving Day.

How to Select and Store

It's worth taking special care in the selection of turkey! Several aspects of turkey selection will help you maximize your health benefits from this World's Healthiest Food. First, we recommend the purchase of fresh turkey. Technically, the U.S. Department of Agriculture (USDA) guidelines allow use of the word "fresh" only when turkey has never been stored a temperature below 26°F (-3°C). (Otherwise, the term "frozen" or "previously frozen" would be required.) Additives like sodium erythorbate, MSG, and salt are not allowed on fresh turkey, and that's a major health advantage for you.

Second, we encourage the purchase of certified organic turkey. Federal organic standards require organic turkey to be raised on organic feed, providing you with a food that is far less likely to contain unwanted contaminants.

However, we also encourage you to go even further in your selection process and choose certified organic turkey that has also been pasture-raised. The terms "free ranging," "free roaming," and "cage free" as allowed on labeling by the USDA do not guarantee that the turkeys actually spent any routine time outdoors in a natural pasture setting. Unfortunately, neither does organic certification. While certified organic turkeys are required to have had "access" to the "outdoors," the actually amount of time spent outside is not specific in the organic regulations and neither is the quality of the space described as "outdoors." So we recommend that you select turkey that is not only certified organic but also pasture-raised. You will usually need to talk to your grocer or the turkey producer to obtain this information. l

One additional important note about organic turkey: don't assume that it won't be available in your local grocery. In a fascinating recent study on poultry purchasing, researchers found that 41% of consumers who had never bought organic turkey assumed that it would not be available in their local store and didn't even consider selecting it because of this assumption. In addition to the fact that many stores already carry organic turkey, you'll find that the members of the meat department staff in your local grocery are often willing to help make organic meats—including organic turkey—available to their customers.

Instead of purchasing skinned turkey breasts at the store to get the lowest fat form of turkey, purchase turkey breasts with the skin still intact. Wait to remove the skin from the turkey breasts after cooking. (In this way you'll improve the moisture, flavor, and aroma of your turkey while not significantly increasing the total fat content.)

However, not all individuals seek the lowest fat version of turkey. Provided that the turkey you select is both organic and pasture-raised, it is likely to contain high-quality fat, including a valuable amount of omega-3s. We realize that most people for personal health reasons will probably be seeking to avoid cuts of turkey that are higher in fat, higher in saturated fat, or higher in calories. However, if you are an individual who has room in your personal meal plan for higher amounts of calories and fats from turkey, you may not necessarily want to choose the lowest-fat version of organic, pasture-raised turkey. The chart below will give you a better idea about cuts of turkey and their fat-related content.

Cuts of Non-Pasture-Raised Turkey and Their Fat-Related Content*

Form of Chicken	Amount	Calories	Total Fat (g)	Saturated Fat (g)	Omega-6 to Omega-3 ratio	Cholesterol (mg)
Breast without skin	4 ounces	153	0.84	0.27	10:1	94
Breast with skin	4 ounces	214	8.4	2.38	11.4:1	84
Leg with skin	4 ounces	236	11.14	3.47	13:1	96
Thigh with skin	4 ounces	178	9.68	3.01	13:1	70

* At present, there is simply insufficient research data to provide an accurate chart for this cut-by-cut, fat-related nutrient content in turkeys who were pasture-raised.

We'd also like to mention a few tips related to the purchase of ground turkey. Just like whole turkey, we encourage the purchase of certified organic and pasture-raised ground turkey since organic standards require organic turkey to be raised on organic feed and since pasture-raising will provide you with greater nutrient benefits. Due to the prohibition of synthetic pesticides and other unwanted contaminants in organic regulations, organic ground turkey (just like organic whole turkey) will also provide you with a food that is far less likely to contain unwanted contaminants.

However, even with organic ground turkey, be careful when reading those prominent labeling claims like "95% fat-free." Those claims are based on the weight of the food, not on the nutrient content. When possible, look on the back of the packaging for a Nutrition Facts Panel, and check serving size and actual grams of total fat and saturated fat per serving. We've seen organic ground turkey that contains 9 grams of fat and 180 calories in 4 ounces, making it 45% fat in terms of calories. This same ground turkey also contained 2.5 grams of saturated fat, or about 13% of the daily limit. For many people (although not everyone), that amount of total fat and saturated fat in a small serving of turkey could be difficult to blend in with an overall balanced diet. Yet we've also seen organic ground turkey that only contained 2 grams of fat, 0.5 grams of saturated fat, and 130 calories in 4 ounces. That second product was only 14% fat in terms of calories—an easier amount to incorporate into an overall diet that is balanced in terms of calories and fat.

Safe handling of turkey is very important! We encourage you to take special care with this food. When you purchase raw turkey, try to make the grocery store your last stop before heading home. When you arrive back home, promptly get your turkey into the refrigerator. In addition, it's worth checking your refrigerator's temperature if you have never done so. A temperature of 40°F/4°C or below is needed for raw turkey safety. Turkey should also be stored in the coldest section of your refrigerator (usually at the bottom, in the back). If the store packaging is intact and secure, store it this way since this will reduce the amount of handling. (The only exception being that if you buy a whole turkey with giblets, it's important to remove the giblets and store them in another container and then rewrap the turkey). Yet, if the packaging is not secure, and it seems as if the turkey liquids will leak, rewrap it securely before storing. This is very important to make sure that the turkey does not contaminate other foods in the refrigerator.

Refrigerated raw turkey can keep for one or two days while cooked turkey will keep for about three-to-four days. Remember to always store the turkey meat separately from any stuffing or gravy you have prepared.

Be very careful when handling raw turkey that it does not come in contact with other foods, especially those that will be served uncooked. Wash the cutting board, utensils, and your hands very well with hot soapy water after handling the turkey.

If your recipe requires marinating, you should always do so in the refrigerator as turkey is very sensitive to heat, which can increase the chances of spoilage. When defrosting a frozen turkey, do so in the refrigerator and not at room temperature. Put the turkey on a plate to collect any liquid drippings.

How to Enjoy

A Few Quick Serving Ideas

- Use ground turkey instead of ground beef in chili con carne recipes. (See our special tips on ground turkey selection provided in the How to Select and Store section.)
- On a bed of romaine lettuce, serve diced turkey, cooked cubed sweet potatoes, cranberries and walnuts. Toss with a light vinaigrette for a salad that emanates the flavors of Thanksgiving.
- Use ground turkey to make turkey burgers or turkey meat loaf. (Once again, see our special tips on ground turkey selection provided earlier.)
- Say olé to turkey burritos. Place cooked turkey pieces on a corn tortilla, sprinkle with shredded cheese and diced tomatoes and onions. Broil for a few minutes until hot.
- Turkey salad can be prepared numerous ways and can be served for lunch or dinner. One of our favorite recipes is to combine the turkey with celery, leeks, dried apricots and almonds.

WHFoods Recipes That Feature Turkey

- Healthy Breakfast Frittata
- 15-Minute Turkey Chef's Salad
- Crispy Turkey Salad
- Turkey and Vegetable Chili Verde
- Holiday Turkey with Rice Stuffing & Gravy with Fresh Herbs
- Roast Turkey Breast with Chipotle Chili Sauce

Safety

Bacterial Contamination of Turkey

Several consumer watchdog organizations in the U.S. have reported frequent contamination of raw turkey - especially raw ground turkey—with unwanted bacteria, including *E. coli*, *Enterococcus*, and *Staphylococcus*. (Similar problems have been identified with raw chicken.) For example, one recent study showed over half of all raw turkey samples to contain the bacterium *Enterococcus durans*. Furthermore, due to the routine use of antibiotics in conventional raising of turkeys, bacteria found on raw turkey have also shown greater antibiotic resistance than expected. One recent study compared organic turkey to conventional turkey, analyzing not only the bacterial content but also the degree of antibiotic resistance. The researchers found that even though the bacterial counts were often similar in conventional versus organic turkey, the degree of antibiotic resistance was significantly higher in bacteria found on the conventional turkey.

If you decide to include turkey in your meal plan, the best way to address these contamination concerns is to use the utmost care in handling and storing turkey and fully cook turkey before you consume it. For more details on proper handling and storing, please see our How to Select and Store and Tips for Preparing and Cooking.

Humane Treatment of Turkeys

An increasing number of consumers have raised questions about the quality of life for turkeys, and a variety of different third-party animal welfare organizations have started to offer certification for turkey producers who would like to display some label on their packaging that address animal welfare issues. In general animal welfare and humane treatment issues include:

- quality of the indoor environment
- access to the outdoors
- quality of the outdoor environment
- quality of the food supply
- naturalness of the food supply
- role of forced molting
- role of beak trimming and debeaking

- flock size
- exposure to natural day/night cycles
- transport standards
- quality of slaughter methods

Unfortunately, current labeling and certification standards do not provide any easy way to assure humane treatment of turkeys when purchasing this food. Like assurance of pasture-raising, assurance of humane treatment is an issue that will require you to follow-up with your grocer or directly with the turkey producer.

Other Controversies

Some animal foods and some plants foods have been the subject of ongoing controversy that extends well beyond the scope of food, nutrient-richness, and personal health. This controversy often involves environmental issues, or issues related to the natural lifestyle of animals or to the native habitat for plants. Turkey has been a topic of ongoing controversy in this regard. Our Controversial Foods Q & A will provide you with more detailed information about these issues.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Turkey, pasture-raised, light meat, roasted
4.00 oz
113.40 grams

Calories: 167
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin B3	13.32 mg	83	9.0	excellent
protein	34.17 g	68	7.4	very good
selenium	34.25 mcg	62	6.7	very good
vitamin B6	0.92 mg	54	5.8	very good
phosphorus	260.82 mg	37	4.0	very good
choline	94.57 mg	22	2.4	good
pantothenic acid	1.02 mg	20	2.2	good
zinc	1.95 mg	18	1.9	good
vitamin B2	0.23 mg	18	1.9	good
vitamin B12	0.42 mcg	18	1.9	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Cheese, grass-fed

Grass feeding is a practice not yet familiar to all consumers. To clarify this for you, 100% grass-fed cheese comes from cows that have grazed in pasture year-round rather than being fed a processed diet for much of their life. Grass feeding improves the quality of the cheese and makes the cheese richer in omega-3 fats, vitamin E, and CLA (a beneficial fatty acid named "conjugated linoleic acid"). (For more detailed information about grass feeding, please click here.)

Just how important is grass feeding for cheese? As you will see in the chart below, we have included grass-feeding as one of our top-level recommendations for anyone who plans to include cheese in their meal plan:

Shopping for Cheese	
Stick with organic	Organic standards help lower risk of contaminated feed and organic cheese usually has higher nutrient quality. However, remember that organic by itself does not guarantee a natural lifestyle for the dairy cows.
Ask for 100% grass-fed	Go beyond organic by asking for 100% grass-fed. Don't get sidetracked by the confusing array of labeling terms like natural" or "pasture-raised." Labeling laws allow products to display these terms even if dairy cows spend little or no time outdoors in a pasture setting. Unfortunately, even the term "grass-fed" is not sufficient since grass-fed dairy cows may have spent a relatively small amount of time grass feeding. The standard to look for on the label is "100% grass-fed." Talk to your grocer or the dairy cow farmer and find out how the animals were actually raised. In addition, if you would like more information about the practice of grass-feeding, please click here.
Consider local farms	Organic, 100% grass-fed cheese may be available from local farms with small flocks, which provide a natural lifestyle for their dairy cows. Two websites that can help you find small local farms in your area are www.localharvest.org and www.eatwild.com. Both sites are searchable by zip code.

Provided that you keep your serving size for grass-fed cheese at 1 ounce or less, we recommend that you consume cheese made from whole milk. Not only is whole milk the least processed form of milk (placing it in the category of a whole, natural food), it's also the form of milk that will provide you with the most omega-3s and other key nutrients when it has been fermented and ripened into cheese.

Traditionally, health organizations have not recommended whole milk cheeses in the diet but rather reduced fat cheeses made from 2%, skim, or nonfat milk. Since too much total fat, too much saturated fat, and too many calories in a daily meal plan can raise the risk of certain health problems, this traditional approach makes sense for individuals who cannot make room in their daily meal plan for the amount of total fat, saturated fat, and calories contained in whole milk cheeses. However, we believe that many people who may want to include a 1-ounce serving of grass-fed cheese in their meal plan will be able to enjoy a whole milk cheese while still remaining within the guidelines for intake of total fat, saturated fat, and calories.

What's New and Beneficial About Grass-Fed Cheese

- Research on food and type 2 diabetes has typically focused on foods that are rich in both protein and fiber, with less attention paid to animal foods like cheese that are rich in protein but don't contain any fiber. However, a recent study from Denmark has shown better regulation of blood sugar levels following moderate intake of cheese (a little less than one ounce per day). In fact, consumption not only of cheese, but also of fermented dairy foods in general (like yogurt), were associated with some blood sugar benefits in this study. The researchers suggested that the presence of two fat-soluble vitamins — vitamins K and D— in cheese was as a possible reason for the blood sugar benefits. Both vitamins have been shown to play a role in blood sugar regulation. Due to the use of vitamin K-synthesizing bacteria as a way to start the cheese fermentation process, vitamin K is present in most cheeses in the form of menaquinone. Vitamin D is present in cheese as a naturally occurring nutrient in cow's milk or as a vitamin added during milk fortification. The calcium-rich nature of cheese may also play a role in beneficial regulation of blood sugar since calcium deficiency—especially in combination with vitamin D deficiency—is a known risk factor for blood sugar problems.
- You're likely to get at least 30 milligrams of CLA (conjugated linoleic acid) from one ounce of grass-fed cheese. CLA is a type of fat associated with a wide variety of health benefits, including immune and inflammatory system support, improved bone mass, improved blood sugar regulation, reduced body fat, reduced risk of heart attack, and maintenance of lean body mass. The amount of CLA in cheese tends to increase along with consumption of fresh grasses by the cows whose milk is used to make the cheese. When cows have had ample year-round access to fresh pasture, you are likely to get increased amounts of CLA, even above the level of 30 milligrams per ounce.
- CLA is not the only fat-related benefit provided by grass-fed cheese. Greater levels of omega-3 fat, less palmitic acid (a long chain saturated fat), and a better ratio of omega-6 to omega-3 fat are additional benefits by grass-fed cheese. You're

likely to get at least 100 milligrams of omega-3 fat from an ounce of most grass-fed cheeses, mostly in the form of ALA (alpha-linolenic acid), but also including a small amounts of DHA (docosahexaenoic acid) in the range of 5-10 milligrams. (Along with eicosapentaenoic acid, or EPA, DHA is one of the most prized omega-3 fats found in fish like salmon.) In the U.S., the average adult has a far too high ratio of omega-6:omega-3 fat in his or her diet. This ratio is often 7:1 or higher. In recent studies, grass-fed cheese has been shown to provide a ratioof 4:1, at most; ratios of 3:1, 2:1, and even 1.5:1 are also often offered by grass-fed cheese.

- Scientists have long been aware of the link between a healthy digestive tract—with ample amounts of "friendly" bacteria—and a healthy immune system. But only recently have researchers begun to investigate this set of issues in relationship to cheese. In particular, researchers have become interested in the digestive and immune benefits potentially associated with intake of "probiotic cheese." This term refers to cheese that has been deliberately inoculated with friendly bacteria able to survive in sufficient numbers in our digestive tract after the cheese is consumed. Even though living bacteria are present in virtually all fermented cheeses, their numbers are often not large enough to affect the balance of bacteria in our digestive tract. When counting up the number of bacteria in a typical cheddar cheese, for example, it would not be uncommon to find 1,000s or perhaps 10,000s of what are called "colony forming units" (or CFUs) per gram of cheese. While these numbers might sound quite high, they are actually not high numbers in relationship to bacteria. The informal industry standard for a probiotic cheese is actually one million CFUs per gram of cheese and some probiotic cheeses may contain billions of CFUs per gram. In several preliminary studies—including one study of older individuals (with an average age of 86 years) consuming one half ounce of probiotic cheese every day for 4 weeks—researchers were able to detect immune system benefits, including increased activity of immune cells and increased numbers of some immune cell types (particularly phagocytes). We expect to see more research in this area in the future with cheese and also with other fermented foods.

Cheese, grass fed, cheddar, whole milk
1.00 oz
(28.35 grams)

Calories: 114
GI: low

Nutrient	DRI/DV
phosphorus	21%
calcium	20%
protein	14%
vitamin B12	10%

Health Benefits

Broad-Based Nutrient Support

When produced with whole milk from 100% grass-fed cows, cheese contains a surprising diversity of nutrients—not just protein and calcium as many people might assume. Whole-milk grass-fed cheeses provide measurable amounts of four key fat-soluble vitamins: vitamins A, D, E, and K. They also provide antioxidant nutrients like selenium, zinc, and beta-carotene, as well as all B-complex vitamins, including B1, B2, B3, B5, B6, B12, choline, and biotin. Whole-milk grass-fed cheeses also provide beneficial fats like omega-3s and CLA, as well as a health-promoting ratio of omega-6:omega-3 fat. There are simply few foods that offer this same diversity of nutrients. For example, while nuts and seeds can provide many of the same fat-related nutrients, they cannot provide a vitamin like B12, which is stored primary in animal foods. While vegetables can provide many of the same antioxidants in even more plentiful amounts, they rarely include measurable amounts of vitamin D. Grass-fed cheese is a truly unique food in terms of its broad range of nutrients.

Blood Sugar Balance

While we might think about cow's milk as a sweet beverage, we don't usually think about cheese as a sweet food—and for good reason. In 4 ounces of whole cow's milk, you will typically find 5-6 grams of total sugar, mostly consisting of lactose ("milk sugar"). Yet in 1 ounce of many fermented cheeses, the total sugar level is not even one-sixth of a gram; as such, fermented cheese contains about 30-40 times less lactose than milk. The reason for this smaller amount of lactose involves the nature of the cheese-making process. In order to start the process, bacteria called "lactic acid bacteria" are often added to help increase the acidity of the milk and make it more likely for some of the milk proteins (caseins) to clump together and form "curd." Lactic acid bacteria are named for their ability to take lactose and convert it lactic acid. Not all cheeses begin the production process through formation of curd with the help of lactic acid bacteria. But when milk is curded in this way, the milk's lactose content is often greatly diminished.

Cheeses curded with the help of lactic acid bacteria combine this low-sugar feature with a rich amount of protein. The high concentration of protein in cheese (it ranks as a "good" source in our WHFoods rating system) has led to its inclusion as a meat substitute in most diabetic exchange systems. Protein-rich foods are often beneficial for blood sugar control because proteins are nutrients that digest at a moderate pace through our digestive tract—not too fast and not too slow.

Along with these factors, whole-milk grass-fed cheese also contains three nutrients known to help balance blood sugar: vitamin K, vitamin D, and calcium. In a recent study from Denmark involving nearly 6,000 men and women between 30-60 years of age, better regulation of blood sugar levels was associated with moderate intake of cheese (a little less than 1 ounce per day). Consumption of other fermented dairy foods (like yogurt) was also associated with some blood sugar benefits in this study. The presence of calcium, vitamin D, and vitamin K in cheese may have played a special role in these blood sugar benefits since each of these nutrients has been independently linked to improved regulation of blood sugar. Interestingly, due to the use of vitamin K-synthesizing bacteria as a way to initiate the cheese fermentation process, vitamin K is present in most cheeses in the form of menaquinone. Vitamin D is present in cheese as a naturally occurring nutrient in cow's milk and sometimes as a vitamin added during milk fortification.

Other Health Benefits

In large-scale human studies, the role of dairy foods—including cheese—in relationship to bone disease, cardiovascular disease, and cancer has been controversial. (We should add that we have yet to see any large-scale human studies examining the relationship between these health problems and cheese made from the whole milk of 100% grass-fed cows.) Some studies have shown decreased risk of these diseases in association with dairy and cheese intake. Other studies have shown increased risk. Yet others have shown no change in either direction.

At least part of these conflicting results may be related to the relatively high total fat, saturated fat, and calorie content of whole milk and whole milk products, coupled with the tendency of many people to consume them in large quantities. To help illustrate this point, let's consider the 1 ounce of whole-milk grass-fed cheddar cheese that we profile on our website. This serving of cheese contains 114 calories, 9.4 grams of total fat, and 6.0 grams of saturated fat. On a percentage basis, it's 74% fat and 47% saturated fat in terms of its nutrient composition. If our entire daily diet — including all foods eaten throughout the day — contained this percent total fat and this percent saturated fat, our risk of many chronic diseases would go up dramatically. But if we take steps to balance our diet while including a higher fat and higher saturated fat food like whole-milk grass-fed cheese, we can stay within public health guidelines and most likely lower our risk of many chronic diseases.

We suspect that health benefits from cheese would be more consistently documented in research studies if the cheese were optimal in quality (100% grass-fed and organic) and if it was incorporated into an overall balanced diet. On an 1,800 calorie meal plan, for example, the 6.0 grams of saturated fat found in 1 ounce of whole milk, grass-fed cheese represent less than 3% of total calories. Since organizations like the American Heart Association (AHA) generally recommend no more than 7% of total calories from saturated fat, you can see how there is room for grass-fed cheese in an 1,800 calorie meal plan, despite it's high saturated fat content. But you can also see how 3 ounces of whole-milk grass-fed cheese could push the saturated fat percentage above a 7% level and cause potential problems. If you enjoy grass-fed cheese and feel like you do well with this food included in your meal plan, you can increase your chances of broad-based health benefits by making sure that your overall diet is balanced, especially with respect to total fat and saturated fat.

Description

Cheese making has been practiced in many cultures throughout the world for at least 8,000 years. It probably began as a way to extend the life of fresh milk while preserving its nutrients. "Milk" used in the making of cheese has not always been synonymous with cow's milk, however. In many cultures, milk used to make cheese has come from other animals, including buffalo, bison, goats, sheep, camels, yaks, horses, and reindeer.

Commercially available cheeses in the U.S. are typically made from cow's milk and can generally be divided into two types: (1) "fresh" cheeses that have not been fermented, are typically very soft in texture, and have a short shelf life, and (2) "ripened" cheeses that have been fermented and aged for a period of weeks, months, or longer and which have a firmer texture and a longer shelf life.

Soft, unripened cheeses include cottage cheese, ricotta, water-packed "fresh" mozzarella, queso fresco, and fromage blanc. Instead of being fermented with the help of bacteria, these unripened cheeses are made by adding either an acidic substance (for example, vinegar, lemon juice or citric acid) or the enzyme rennet to the milk, or in some cases both. Acidic substances and rennet will cause the casein proteins in milk to coagulate and form "curds." (Rennet has the advantage of producing a stronger and more gel-like consistency in the curds.) Once the watery "whey" portion of the milk is drained off, only the curds are left and those curds are what we call "unripened" cheese. Unless a cheese has been aged for 60 days or longer, it must be made from pasteurized milk if sold in the U.S. and this rule applies to all of the unripened cheeses listed above.

Ripened cheeses are cheeses that not only undergo the curding process described above but also a fermentation process in which bacteria and other micro-organisms are added to the cheese and given time to develop new textures, flavors, and aromas. While ripened cheeses might initially be curded in the same way as unripened cheeses—namely, through addition of acid substances like lemon juice, vinegar, or citric acid to cause the formation of curds—many are not curded in this way. Instead, they are curded with the help of "starter bacteria." To accomplish curding in this way, lactic acid bacteria (LAB) are added to the milk. LAB will consume the lactose (milk sugar) present in the milk and convert it into lactic acid. Like vinegar and lemon juice, the lactic acid produced by LAB is an acidic substance that will cause the milk to curd. LAB commonly used to start acid coagulation process include *Lactococcus lactis*, *Streptococcus thermophiles*, *Lactobacillus helveticus*, and *Lactobacillus delbreuckii*. For persons who are lactose intolerant and experience an adverse reaction to dairy products because of their lactose content, the use of starter bacteria to begin the cheese making process can be a plus since these bacteria can convert much of the lactose in milk to lactic acid. In 4 ounces of whole cow's milk, you'll typically get 5-6 grams of total sugar, mostly consisting of lactose. In 1 ounce of whole milk cheese that has been curded with the help of starter bacteria, you'll get one-thirtieth, one-fortieth, or even one-fiftieth this amount. This greatly reduced amount of lactose is sometimes low enough to be tolerated even by individuals who are lactose intolerant.

In order to complete the process of producing a ripened cheese, the first round of "starter bacteria" used to produce lactic acid and trigger formation of the curd is followed by a second round of "ripening bacteria" whose job is to ferment the curd and develop the unique textures, flavors, and aromas found in ripened cheeses. During the ripening stage, yeasts and molds may be added along with bacteria to develop the unique cheese characteristics. Ripening of cheese may take weeks, months, or years, depending on the goals of the cheesemaker and the preferences of the consumer. Some ripened mozzarella cheeses may have only been ripened for a few weeks while some grocery store cheddars may have been aged for over ten years. Below is a chart showing some of the microorganisms used during the starter or ripening stage for some well-known ripened cheeses.

Cheese type	Example of microorganisms used for ripening	Total ripening time
Blue	*Penicillium roquefortii* (mold)	2-6 months
Brie	*Penicillium camemberti* (mold)	4-8 weeks
Cheddar	*Lactobacillus paracasei*, *Lactobacillus casei*, *Lactobacillus plantarum* (bacteria)	4 weeks to 10 years depending on type
Feta	*Lactobacillus brevis*, *Lactobacillus plantarum*, *Lactobacillus fermentum*, *Lactobacillus coryniformis* (bacteria); *Kluyveromyces, Pichia*, *Candida* (yeasts)	4-6 weeks, and sometimes longer
Gruyere	*Candida*, *Debaryomyces*, *Kluyveromyces* (yeasts)	5 months to 2 years
Parmesan	*Lactobacillus helveticus*, *Lactobacillus delbreuckii* (bacteria)	9-24 months
Swiss	*Propionibacterium freudenreichii*, *Propionibacterium jensenii*, *Propionibacterium thoenii*, *Propionibacterium acidiproionici* (bacteria)	3-9 months

Ripened cheeses are sometimes classified by geography. "American" cheeses typically include cheddar, colby, jack, colby jack, monterey, and monterey jack. Italian cheeses include mozzarella, Parmesan, provolone, and Asiago. For Hispanic cheeses the list includes queso blanco, queso fresco, cotija, and panela. However, consumers across the world enjoy many of the cheeses regardless of location, and most cheese types are produced in cheese-producing countries.

"Probiotic" cheeses

Increasingly popular in the U.S. marketplace are "probiotic" cheeses that contain greater amounts of "friendly" bacteria than other cheeses. Virtually all fermented cheeses contain living bacteria. But the number of living bacteria in any given cheese may be relatively small. Bacteria in cheese are usually measured in what are called "colony forming units" or CFUs. A fermented cheese may typically contain 10,000's of CFUs per gram or perhaps 1,000's of CFU's per gram. By contrast, a probiotic cheese that has been deliberately inoculated with friendly bacteria (that will be able to survive in large numbers in our digestive tract after the cheese is consumed) may contain millions or even billions of CFUs. (An informal and voluntary industry standard for a probiotic cheese is one million CFUs per gram of cheese.) In one preliminary study of older individuals (with an average age of 86 years) consuming one-half ounce of probiotic cheese every day for 4 weeks, researchers were able to detect immune system benefits, including increased activity of immune cells and increased numbers of some immune cell types (particularly phagocytes).

Non-dairy cheeses

After experiencing an adverse reaction to cheese, many consumers have looked for cheese substitutes not made from cow's milk. Many companies now produce non-dairy cheeses, including soy cheeses, rice cheeses, and almond cheeses. These non-dairy cheeses are sometimes referred to as "vegan" cheeses since their baseline ingredients often come from legumes, nuts, or grains rather than animal milk. As a general rule, however, we recommend a note of caution when choosing non-dairy cheeses as a regular part of your meal plan. Some "non-dairy" cheeses actually add casein proteins into the cheese, and it is common to find vegetable oils, vegetable flours, and added flavorings in these cheeses. For all of the above reasons, we would describe many non-dairy cheeses as being more highly processed than traditionally fermented cheeses. And because most non-dairy cheeses are not made through a fermentation process, it is often difficult for them to take on the unique textures, flavors, and aromas of fermented cheese. If you can find vegan cheeses that have been fermented and aged in the same way as animal milk cheeses, they are almost always your best option in this area of non-dairy cheeses.

One added note on "non-dairy" cheeses: some people make a distinction between cow's milk and the milks of other animals when using the word "dairy." In other words, they refer to cow's milk cheese as a "dairy" product, but they refer to goat milk cheese or sheep milk cheese as "non-dairy." Regardless of the term used, however, cow's milk, goat's milk, and sheep's milk have some important commonalities in terms of their chemical composition and also some important differences. Because there is no simple rule about the composition of milks from different animals, there is also no simple way to predict how a person will react to cheeses made from different types of animal milks. For example one people may do better on goat's milk cheese than cow's milk cheese, but another person may not. If you are actively trying to figure out a way to include non-cow's milk cheeses in your regular meal plan, you may want to seek the help of a healthcare practitioner to help you determine your best steps in this area.

History

As described earlier, cheese making has been practiced in many cultures throughout the world for at least 8,000 years. The popularity of animal milk made it natural for people to try and preserve the "shelf life" of fresh milk along with its valuable nutrients. From a historical perspective, the milk used to make cheese did not come mainly from cows. Many different animals were valued for their milk, including buffalo, bison, goats, sheep, camels, yaks, horses, and reindeer. Early on in human history, cheese was made from the milk of all of these animals.

In 2012, 912 million pounds of cheese were produced in the U.S., with Italian cheeses (e.g., mozzarella, Parmesan, provolone, ricotta and Romano) and American cheeses (e.g., cheddar, Colby, Monterey, jack) each accounting for about 40% of the total. The remaining 20% included cream cheese, Nufchatel, Swiss, and Hispanic cheeses.

While you might expect production and consumption of cheese in the U.S. to follow closely after production and consumption of milk, these two dairy products have undergone a very different trend in the U.S. marketplace. Over the past 40 years, U.S. milk production has increased by about 50%, although consumption of milk as a beverage in liquid form has decreased by about 30%. By contrast, consumption of cheese in the U.S. has nearly doubled from an annual per capita rate of about 17 pounds in 1980 to nearly 34 pounds in 2012. Some of cheese's increasing popularity involves increasing availability of ethnic cuisines that include unique cheese varieties long-valued in cultural traditions.

With over 2.5 billion pounds of cheese produced in 2011, Wisconsin led the U.S. states in terms of cheese production. California was the country's second largest cheese producer at 2.25 billion pounds. Cheddar and mozzarella accounted for about two-thirds of all cheese produced.

How to Select and Store

There are different purchase qualities to look for depending upon the cheese type. Soft cheeses should be uniform in color throughout, and the cheese should fill out the crust casing, which itself should be free from cracks and not too dry. Semi-firm cheese should not be too crumbly or dry with the color being relatively uniform. Hard cheeses should be uniform in color and have a firm, uncracked rind that is not too dry or pasty. Bleu cheeses should be not too dry nor too crumbly, and should feature veining that is evenly distributed.

If your market has a cheese department, speak with the person who specializes in cheese. She or he can help you choose the best quality cheese as well as introduce you to different cheeses that you may not have yet tried, which can help you to expand your repertoire and more greatly appreciate this wonderful food.

All cheeses, regardless of variety, should be well wrapped and kept in the warmest section of the refrigerator. (The refrigerator door is often one of the warmest spots). As storage life is related to the moisture content of the cheese, the softer the cheese, the shorter amount of time it will keep fresh. In general, firm and semi-firm cheeses will keep for two weeks while soft and grated cheeses will keep for about one week.

How to Enjoy

A Few Quick Serving Ideas

When considering any of the serving ideas below, please continue to select grass-fed versions of all cheeses whenever possible.

- Combine feta cheese with chilled cooked lentils, minced red onion and diced green pepper for a delicious cold salad.
- Enjoy a classic Italian salad—sliced onions, tomatoes and mozzarella cheese drizzled with olive oil.
- Freshly grated cheese makes a nice addition to most any green salad.
- For a quick, healthy "pizza," sprinkle mozzarella cheese on a whole wheat pita, top with tomato sauce and your favorite vegetables and cook briefly in toaster oven, just until the cheese melts.
- Enjoy this refreshing salad—combine sliced fennel and orange pieces together and top with grated Parmesan cheese.
- Small amounts of cheese makes a delightful pairing with fruits such as apples, pears and melons. Serve as appetizer or dessert.

For some of our favorite recipes, click Recipes.

Safety

Cheese is a complicated food in terms of potential adverse reactions. We'd like to give you some detailed information that you may find helpful if you want to include cheese in your meal plan but are also concerned about this food as a good fit for you individually.

Cheese and Adverse Reactions

Milk and the foods made from it, including cheese, are among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. Some people also have an intolerance to cheese owing to the lactose sugar that it contains. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions.

Cheese and Amines

In general, the longer a cheese is aged, the more digestible it becomes. The reason for this increased digestibility is simple—more of the fats and proteins in the cheese are broken down over time by living bacteria and other microorganisms present in the cheese. It wouldn't be wrong to described highly aged cheeses as "pre-digested," in the sense of having many of their proteins and fats already broken down before the cheese is consumed as a food.

While generally more digestible and less likely to cause an adverse reaction for this very reason, aged cheeses are problematic for some individuals who experience adverse reactions to protein-related substances called "amines." One of the changes that can happen during cheese aging is conversion of protein building blocks—called amino acids—into amines. Many bacteria are able to trigger this conversion process. These bacteria can take an amino acid like tyrosine and convert it into the amine called "tyramine." Similarly, they can take the amino acid tryptophan and convert it into the amine called "tryptamine." And they can take the amino acid histidine and convert it into the amine called "histamine." Tyramine, tryptamine, and histamine are examples of molecules sometimes referred to as "bioactive amines." This term is used to indicate the ability of tyramine, tryptamine, and histamine to influence nervous system and brain metabolism in susceptible persons. A migraine headache is a prominent example of the unwanted effect that dietary amines can sometimes have on a person who is sensitive to their presence in food. If you already know that you are sensitive to amines in food, you may want to avoid all cheeses in your meal plan. If you experience adverse reactions to cheese, do not know why, but still want to include cheese in your meal plan if possible, you will probably need the help of a healthcare practitioner to figure out whether amines in fermented cheeses are an issue, or whether you are experience adverse reactions for other reasons.

Rennet

As described earlier, rennet is an enzyme often used to help trigger coagulation of casein proteins in milk and the formation of cheese curds. Researchers have actually pinpointed the exact role of rennet in this process. There are typically four basic types of casein proteins found in cow's milk, and they are often found floating around throughout the milk in small clusters called micelles. One specific type of casein protein—called kappa casein—is found on the surface of these clusters.

Kappa casein has a small hair-like projection that sticks out into the watery fluid portion of the milk and attracts water. This characteristic of the kappa casein allows the casein clusters to stay dispersed throughout the milk. The rennet enzyme, when added to milk, works to cut the kappa caseins hairs in such a way that the casein clusters begin to repel water rather than attracting it. Once the clusters begin repelling the water, they naturally start clumping together and forming "curd." By altering the kappa casein molecules, rennet is able to trigger a more gel-like formation of curd that is also relatively sturdy. For these reasons, cheese makers often prefer to include some rennet when beginning the curding process.

In order to help them digest their mother's milk, calves naturally produce rennet in their stomachs. In the cheese-making industry, rennet has often been obtained from the stomachs of young calves slaughtered for production of veal, usually between 16-18 weeks of age. For ethical reasons, some individuals seek to avoid cheeses produced with the use of rennet from slaughtered calves. These individuals draw a distinction between the obtaining of milk from animals in a non-harmful way and the making of cheese from this milk, versus the harm done to animals to obtain an enzyme for the cheese-making process. In the U.S. marketplace, more and more cheeses are becoming available which feature alterntatives to calf-based rennet. Some of these cheeses are produced with plant-based rennet. Examples of plants that can serve as a source for rennet include nettle, thistle, safflower, and fig (leaf or bark). Bacterially derived rennet is also used in the production of some cheeses as an alternative to calf rennet. We've also seen cheeses made with genetically modified rennet, but these cheeses would be prohibited from sale as organic since certified organic foods cannot contain genetically modified components, and we do not recommend cheeses made in this way. Look for the terms "rennet free" or "vegetarian rennet" on the label of your cheese if you are seeing to avoid calf-based rennet.

Other Controversies

Some animal foods and some plants foods have been the subject of ongoing controversy that extends well beyond the scope of food, nutrient-richness, and personal health. This controversy often involves environmental issues, or issues related to the natural lifestyle of animals or to the native habitat for plants. Cheese has been a topic of ongoing controversy in this regard. Our Controversial Foods Q & A will provide you with more detailed information about these issues.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Cheese, grass fed, cheddar, whole milk
1.00 oz
28.35 grams

Calories: 114
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
phosphorus	145.15 mg	21	3.3	good
calcium	204.40 mg	20	3.2	good
protein	7.06 g	14	2.2	good
vitamin B12	0.24 mcg	10	1.6	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%

good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Cow's milk, grass-fed

Grass feeding is a practice not yet familiar to all consumers. 100% grass-fed cow's milk comes from cows who have grazed in pasture year-round rather than being fed a processed diet for much of their life. Grass feeding improves the quality of cow's milk, and makes the milk richer in omega-3 fats, vitamin E, beta-carotene, and CLA (a beneficial fatty acid named conjugated linoleic acid). (For more detailed information about grass feeding, please click here.) Just how important is grass feeding for cow's milk quality? As you will see in the chart below, we have included grass feeding as one of our top-level recommendations for anyone who plans to include cow's milk in their meal plan:

Shopping for Cow's Milk	
Stick with organic	Organic standards help lower risk of contaminated feed and organic cow's milk usually has higher nutrient quality. However, remember that organic by itself does not guarantee a natural lifestyle for the dairy cows.
Ask for 100% grass-fed	Go beyond organic by asking for 100% grass-fed. Don't get sidetracked by the confusing array of labeling terms like natural" or "pasture-raised." Labeling laws allow products to display these terms even if dairy cows spend little or no time outdoors in a pasture setting. Unfortunately, even the term "grass-fed" is not sufficient since grass-fed dairy cows may have spent a relatively small amount of time grass feeding. The standard to look for on the label is "100% grass-fed." Talk to your grocer or the dairy cow farmer and find out how the animals were actually raised. In addition, if you would like more information about the practice of grass feeding, please click here.
Consider local farms	Organic, 100% grass-fed cow's milk may be available from local farms with small flocks, which provide a natural lifestyle for their dairy cows. Two websites that can help you find small local farms in your area are www.localharvest.org and www.eatwild.com. Both sites are searchable by zip code.

One thing you'll notice about the chart above is an absence of recommendations about percent fat. Provided that you keep your serving size for grass-fed cow's milk at 4 ounces or less, we recommend that you consume it in the form of whole milk. Not only is whole milk the least processed form of milk (placing it in the category of a whole, natural food), it's also the form of grass-fed milk that will provide you with the most omega-3s and other key nutrients. Traditionally, health organizations have not recommended whole milk in the diet but rather reduced fat milk, including 2%, skim, and nonfat milk. Since too much total fat, too much saturated fat, and too many calories in a daily meal plan can raise the risk of certain health problems, this traditional approach makes sense for individuals who cannot make room in their daily meal plan for the amount of total fat, saturated fat, and calories contained in whole milk. However, we believe that many people who may want to include a 4-ounce serving of grass-fed milk in their meal plan will be able to include it in the form of whole milk while still remaining within the guidelines for intake of total fat, saturated fat, and calories.

What's New and Beneficial About Grass-Fed Cow's Milk

- CLA (conjugated linoleic acid) is a type of fat associated with a wide variety of health benefits, including immune and inflammatory system support, improved bone mass, improved blood sugar regulation, reduced body fat, reduced risk of heart attack, and maintenance of lean body mass. According to recent studies, you'll find yourself getting at least 75 milligrams of CLA from an 8-ounce serving of grass-fed cow's milk. (In some cases, you may even get two to three times this amount. The amount of CLA in cow's milk tends to increase along with consumption of fresh grasses by the cows, and when cows have had ample access to fresh pasture, you are likely to get increased amounts of CLA.) Since the CLA content of milk from 100% grass-fed cows is typically two to fives times greater than the CLA content of milk from conventionally fed cows, 100% grass-fed milk can provide you with increased health benefits in the areas described above.
- Improved intake of omega-3 fat is another health benefit that can be obtained from 100% grass-fed cow's milk. The omega-3 fat content of grass-fed cow's milk can vary widely, due to the wide variety of forage crops that can be planted in pastures (or that grow on pastureland in the wild). This omega-3 content also varies with the age, breed, and health of cows and seasonal plant cycles in pastureland. At the lower end of the spectrum, recent research shows 50-65 milligrams of omega-3s (in the form of alpha-linolenic acid, or ALA) in 8 ounces of grass-fed cow's milk. At the higher end of the spectrum, those same 8 ounces may provide 120-150 milligrams of omega-3s. While these amounts of ALA are not large, they're going to be helpful to many individuals who are deficient in omega-3s. The relatively low ratio of omega-6s to omega-3s in 100% grass-fed cow's milk may also enhance the benefits that you get from these omega-3s. This ratio typically falls between 2:1 and 3:1—quite unlike the ratio in milk from traditionally fed cows, which often fall into the range of 8:1 or higher. Since omega-6 metabolism can interfere with omega-3 metabolism, the relatively reduced

amounts of omega-6s in 100% grass-fed cow's milk may help improve the metabolism of omega-3s in your body after you've consumed the milk.

- Based on recent research studies, the overall fat composition of 100% grass-fed milk is not what you might think. There are about 8 grams of total fat in 8 ounces of whole grass-fed cow's milk. About 2 grams (or 25%) come from monounsaturated fat in the form of oleic acid. This omega-9 fatty acid is the primary fatty acid found in olive oil, and when it replaces other types of fat in the diet, it's been linked to reduction in high blood pressure as well as reduction in high blood cholesterol levels. About 4.5 grams (or 56%) come from saturated fat - a type of fat that we often associate with unwanted health consequences. However, the type of saturated fat in 100% grass-fed cow's milk does not fully fit the "unwanted" fat category. About 6-7% of this saturated fat is "short-chain" saturated fat and it can function as a "probiotic" that supports the health of friendly bacteria in the intestine. Nearly half of the saturated fat is "medium chain" saturated fat—the kind that is predominant in coconut oil. Medium chain saturated fat is more easily digested and metabolized in the body, and in some studies, it's been associated with immune system benefits. Within the 4.5 grams of saturated fat in 8 ounces of 100% grass-fed whole milk, only 25-30% come from palmitic acid—a long chain fat that's been more closely associated with heart disease risk than other saturated fats. When taken as a whole, the fat composition of 100% grass-fed whole cow's milk is much more balanced in terms of health risks and benefits than many people assume.

Cow's milk, grass-fed
4.00 oz
(122.00 grams)

Calories: 74
GI: low

Nutrient	DRI/DV
vitamin B12	23%
iodine	19%
vitamin B2	16%
vitamin D	16%
phosphorus	15%
calcium	14%
pantothenic acid	9%
selenium	8%
protein	8%
biotin	8%
vitamin A	6%

Health Benefits

Broad-Based Nutrient Support

When obtained from 100% grass-fed cows, whole milk contains a surprising diversity of both conventional and phytonutrients. In the conventional category, you'll find milk to be a very good source of vitamin B2 (riboflavin), vitamin D, and vitamin B12. It's also a very good source of the minerals iodine and phosphorus, and a good source of calcium. Our rating system also qualifies whole cow's milk as a good source of protein.

As described previously, the fat composition of 100% grass-fed whole cow's milk is not what you might think. In an 8-ounce serving, you're likely to get at least 50-65 milligrams of omega-3s (in the form of alpha-linolenic acid, or ALA) and perhaps as much as 120-150 milligrams. You're also going to get a relative low ratio of omega-6:omega-3 fat in the range of 2:1 to 3:1. That ratio is healthier than the 8:1 (or higher) ratio you're likely to get from conventionally fed cows, and it's also much healthier than the ratio currently consumed by the average U.S. adult. Included within the fat composition of 100% grass-fed whole milk is CLA (conjugated linoleic acid), a type of fat associated with immune, cardiovascular and other benefits.

In terms of phytonutrients, you're likely to get 16-40 micrograms of beta-carotene in 8 ounces of 100% grass-fed whole cow's milk, along with isoflavones like formononetin, biochanin A, and prunetin depending on the type of fresh pasture and silage consumed by the cows. You're also like to get lignans like secoisolariciresinol and matairesinol, once again, depending on the cows' diet. The chart below gives some simple examples of the relationship between a cow's diet and phytonutrients in milk.

Type of Silage	Phytonutrients Found to Increase in the Cow's Milk
red clover	formononetin (isoflavone)
alfalfa	biochanin A (isoflavone) and prunetin (isoflavone)
birdsfoot trefoil	secoisolariciresinol (lignan) and matairesinol (lignan)

Grass silage has also been shown to increase the beta-carotene content in grass-fed cow's milk to levels of approximately 40 micrograms in 8 ounces. These levels are about 4 times higher than the amount of beta-carotene found in conventional cow's milk.

Antioxidant Support

Antioxidants found in 100% grass-fed whole milk can include the isoflavones formononetin, biochanin A, and prunetin. Antioxidant lignans can include secoisolariciresinol and matairesinol. Vitamin antioxidants include vitamin E (which is increased by about 50% in milk from 100% grass-fed cows versus conventionally fed cows) and mineral antioxidants include selenium and zinc. Grass feeding also increases the amount of another key antioxidant—beta-carotene—in cow's milk. At approximately 40 micrograms per 8 ounces, this level is about 4 times higher than the level in milk from conventionally fed cows.

Other Health Benefits

There are preliminary studies on the health benefits of cow's milk in a variety of areas. However, we're not aware of any large-scale studies done exclusively on 100% grass-fed whole milk. Most of the studies have been conducted using milk from conventionally fed cows on relatively small groups of participants. Within this context, there is some evidence of improved weight loss and improved fat loss when cow's milk is incorporated into a closely monitored low-calorie diet.

There is also evidence of decreased risk of gout in both men and women when milk is consumed in relatively high amounts (averaging at least one cup per day, and often 2-4 cups). Researchers are not clear about the mechanism of action here, but continue to look at relationships between increased intake of cow's milk and decreased levels of uric acid in the blood. (High levels of uric acid usually precede the occurrence of gout.)

While cow's milk has been widely promoted as a source of calcium and good bone health, we have not seen large-scale studies showing significantly improved bone health in adults who regularly consume cow's milk. We have seen several studies involving decreased risk of bone fracture in children and teens who regularly consume milk, and we've also seen animal studies showing reduced risk of osteoporosis following regular milk consumption. Some of the research on bone health and the natural nutrient composition of cow's milk is complicated by widespread fortification of cow's milk with vitamin D. (Vitamin D plays an important role in bone health, and the addition of vitamin D to cow's milk during processing might account for improved bone health.)

Studies on the relationship between cow's milk intake and cancer risk are confusing, and to a certain extent, contradictory. Some studies have shown mild decreases in cancer risk (for example, breast cancer in one group of French women), while other studies have shown mild increases in risk (for example breast cancer in one group of Japanese women). Other studies have shown no connection between cow's milk intake and cancer risk. We have yet to see any large-scale studies that examined the relationship between milk from 100% grass-fed cows and cancer of any type.

Some of this confusion might be related to the widespread presence of hormonal residues in cow's milk from conventionally fed cows, which may have increased cancer risk. These hormonal residues can have two sources. First, hormones may have been injected into the cows or added to their feed in order to increase rate of growth or milk yield. But equally important may be higher levels of hormones produced by the cows themselves. Unlike milking practices adopted by ancient nomadic cultures that restricted milking to the early months of pregnancy (when hormonal levels in the pregnant cows were relatively low), modern dairy farms maintain pregnancy in dairy cows about 80% of the year and milk throughout pregnancy, even during months when hormonal levels are relatively high.

Description

Like their fellow mammals, female cows can produce milk through the process called lactation. (In fact, the very word "mammal" refers to this milk-producing process, since milk is produced by the mammary glands in female animals and *mamma* in Latin means "breast.") While this distinction holds true for all female cows, not all female cows are considered dairy cows. In the commercial milk industry, dairy cows consist of very specialized breeds that can produce very large amounts of milk. Over 90% of dairy cows in the U.S. are black and white Holsteins. After Holsteins, the most common U.S. dairy cows are Jerseys. Other dairy breeds include Ayrshires, Brown Swiss, and Guernseys.

Around two years of age, female dairy cows typically have their first calf, and along with calving, they begin to produce milk (lactation). Through a combination of steps (usually including artificial insemination to re-initiate pregnancy following the end of the first lactation cycle), dairy cows can be managed in such a way as to produce milk about 80% of the year for a period of

6-10 years. Specialized milking breeds like the ones described above average about 20,000 pounds of milk per year in the U.S., with some cows producing up to 37,500 pounds.

All cows belong to the *Bovidae* family of cloven-hooved, ruminant animals that includes bison, buffalo, sheep, goats, antelopes, gazelles, and muskoxen. Most also belong to the *Bos Taurus* genus and species in this animal family.

History

Many animals—including cows—have been milked for the purpose of providing humans with food for thousands of years. However, cows were not native to North America and did not arrive in what is now the United States until the 15th century AD when the Spanish brought them on ships from Europe. Over the next three and one-half centuries, most of the cows present in the U.S. belonged to families on family farms. It was not until the 1900's that the dairy industry as we know it today began to develop, following invention of the pasteurization process and other events (such as the capacity to test dairy herds for the infectious disease tuberculosis).

Today there are approximately nine million dairy cows in the U.S., with five states (California, Wisconsin, New York, Pennsylvania, and Idaho) accounting for most of U.S. dairy production. This total number of dairy cows is about 25% lower than the number of dairy cows in the 1970's. However, even though the total number of dairy cows has decreased, the total volume of milk from these cows has nearly doubled to an average level of about 20,000 pounds per year. In the U.S. the average dairy herd size is approximately 100 cows—translating into about 90,000 dairy farms in all U.S. states combined.

How to Select and Store

When purchasing milk, always use the "sell-by" date as a guide to the shelf life of the milk. Smell the top of the container to make sure that the milk doesn't smell of spoilage that could have been caused by being stored for a period of time outside of the refrigerator. Select milk from the coldest part of the refrigerator case, which are usually the lower sections.

Milk should always be refrigerated since higher temperatures can cause it to turn sour rather quickly. Always seal or close the milk container when storing it to prevent the milk from absorbing the aromas of other foods in the refrigerator. Avoid storing milk on the refrigerator door since this exposes it to too much heat each time the refrigerator is opened and closed.

How to Enjoy

A Few Quick Serving Ideas:

- Blend together milk, a banana and your other favorite fruits for a delicious shake.
- Add milk, raisins, cinnamon and nutmeg to a pot of cooked brown rice to make rice pudding.
- Make hot chocolate by combining milk, unsweetened dark chocolate and honey in a saucepan over low heat. Stir frequently.
- Splash some milk over your morning bowl of hot cereal.

For some of our favorite recipes, click Recipes.

Safety

Milk and Adverse Reactions

Milk is among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. Some people also have an intolerance to milk owing to the lactose sugar that it contains. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions.

Production and Processing of Cow's Milk

Both consumers and scientists have raised concerns about the production and processing of cow's milk. Three areas of special concern include pasteurization and and homogenization. We've created in-depth Q & As in each of these areas. For more detailed information, please click on either of the links below:

- Homogenization

- Pasteurization

Other Controversies

Some animal foods and some plants foods have been the subject of ongoing controversy that extends well beyond the scope of food, nutrient-richness, and personal health. This controversy often involves environmental issues, or issues related to the natural lifestyle of animals or to the native habitat for plants. Cow's milk has been a topic of ongoing controversy in this regard. Our Controversial Foods Q & A will provide you with more detailed information about these issues.

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Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Cow's milk, grass-fed
4.00 oz
122.00 grams

Calories: 74
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin B12	0.55 mcg	23	5.5	very good
iodine	28.06 mcg	19	4.5	very good
vitamin B2	0.21 mg	16	3.9	very good
vitamin D	62.22 IU	16	3.8	very good
phosphorus	102.48 mg	15	3.5	very good
calcium	137.86 mg	14	3.3	good
pantothenic acid	0.46 mg	9	2.2	good
selenium	4.51 mcg	8	2.0	good
biotin	2.32 mcg	8	1.9	good
protein	3.84 g	8	1.9	good
vitamin A	56.12 mcg RAE	6	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Eggs, pasture-raised

Shopping for Eggs	
Stick with organic	Organic standards help lower risk of contaminated feed and organic eggs usually have higher nutrient quality. However, remember that organic by itself does not guarantee a natural lifestyle for the egg-laying chickens.
Ask for pasture-raised	Go beyond organic by asking for pasture-raised. Don't get sidetracked by the confusing array of labeling terms. You are likely to find phrases like "pasture-raised," "pastured," "free-range" and "cage-free" on egg packaging, but labeling laws allow products to display these terms even if the egg-laying chickens spend little or no time outdoors in a pasture setting. Talk to your grocer or the chicken producer and find out how the chickens were actually raised.
Consider local farms	Organic, pasture-raised eggs may be available from local farms with small flocks and a natural lifestyle for their chickens. Two websites that can help you find small local farms in your area are www.localharvest.org and www.eatwild.com. Both sites are searchable by zip code.

One additional note about egg selection—we frequently get questions about the advisability of raw egg consumption. In our detailed Q & A on this topic, we review the research-based pros and cons of eating raw eggs and we provide you with some practical recommendations in this area.

What's New and Beneficial About Eggs

- Virtually all egg yolks contain omega-3 fats. However, the amount of omega-3s varies with the amount of foods containing omega-3s that are eaten by the hen. In recent years, a marketplace trend has witnessed the development of omega-3 enriched eggs through the addition of omega-3 oils to the hen's feed. These oils have included menhaden oil, krill oil, flaxseed oil, and algae oil. Not surprisingly, the amount of omega-3s in an egg yolk can be increased by three to five times through supplementation of the hen's diet with these oils. Eggs with as much as 250 milligrams of omega-3s per yolk have been produced in this way. While these omega-3 benefits are clearly substantial, what we have been more excited to see in recent research studies is the ability of a hen's natural diet to increase the omega-3s in her eggs. Unlike some approaches to omega-3 enrichment that might involve the addition of processed oils to an already unnatural diet, pasture feeding approaches that offer the hen a generous amount of legumes rich in omega-3s—like clover and alfalfa—make more sense to us. So it's been exciting to see studies that show significantly increased amounts of omega-3s in eggs through natural pasture feeding alone.
- While organizations like the American Heart Association (AHA) allow for regular consumption of eggs in a meal plan, they typically warn that eggs are difficult to include because of their high cholesterol content and potential for increasing risk of heart disease. For persons with health blood cholesterol levels not needing cholesterol-lowering drugs, the AHA recommends a maximum of 300 milligrams of cholesterol per day from food. Since one conventionally produced egg contains about 180-220 milligrams of cholesterol, about two-thirds of the daily limit gets used up by consumption of one egg. Interestingly, several recent large-scale diet studies suggest that the cholesterol content of an egg may be less of a concern in relationship to heart disease than previously thought. In these studies, no increased risk of either heart attack or stroke was shown with intake of one to six eggs per week. (One exception involved participants with type 2 diabetes, whose risk of heart problems was associated with egg intake, even in the range of one to six eggs per week.) Equally interesting was the link between egg intake and increased levels of HDL cholesterol (the "good" cholesterol) in participants. Not only did egg intake increase the number of HDL molecules, it also improved their composition and allowed them to function more effectively.
- Pasture feeding of hens has been shown to significantly increase the vitamin E content of their eggs. In a recent study comparing caged hens to hens foraging on grasses and legumes, vitamin E in the yolk of eggs from hens who foraged on pasture was about 200% greater than vitamin E in the yolk of eggs from caged hens. Interestingly, hens that foraged more on grasses than legumes developed about 25% more vitamin E in their eggs. Hens, of course, are omnivores and eat a wide variety of foods, including grasses, legumes, seeds, worms, grubs (insect larvae), and adult insects.

Eggs, pasture-raised, large, hard boiled
1.00 each
(50.00 grams)

Calories: 78
GI: low

Nutrient	DRI/DV
choline	35%
selenium	28%
biotin	27%

vitamin B12	23%
vitamin B2	20%
molybdenum	19%
iodine	18%
pantothenic acid	14%
protein	13%
phosphorus	12%
vitamin D	11%
vitamin A	8%

Health Benefits

Broad Nutrient Support

Eggs have long been recognized as a source of high-quality protein. The World Health Organization (WHO) and other public health authorities actually use eggs as their reference standard for evaluating the protein quality in all other foods. Egg protein is usually referred to as "HBV" protein, meaning protein with High Biological Value. Since eggs are used as the reference standard for food protein, they score 100% on the HBV chart. The high quality of egg protein is based on the mixture of amino acids it contains. (Amino acids are the building blocks for making proteins.) Eggs provide a complete range of amino acids, including branched chain amino acids (leucine, isoleucine, valine), sulfur-containing amino acids (methionine, cysteine), lysine, tryptophan, and all other essential amino acids. Their protein is sometimes referred to as a "complete protein" for this reason.

All B vitamins are found in eggs, including vitamins B1, B2, B3, B5, B6, B12, choline, biotin, and folic acid. Choline is a standout among these B vitamins. In fact, eggs rank higher in choline than any of our other WHFoods. In the U.S., an average diet provides about 300 milligrams of choline per day - less than the recommended amount for an adult woman (425 milligrams) or an adult man (550 milligrams). Since one egg provides over 100 milligrams of choline and only 75-80 calories, it provides far more choline for far less calories than most other choline-rich foods.

The mineral content of eggs also deserves special mention here--not because eggs are a rich source of most minerals but because they are a rich source of certain minerals that can sometimes be difficult to obtain from other foods. Eggs are a very good source of both selenium and iodine. While many fish, shellfish, and mushrooms can be rich sources of selenium, persons who avoid these foods may sometimes have difficulty getting an adequate amount of this important antioxidant mineral from food. For persons who do not use iodized salt in recipes or at the table and who do not consume either yogurt or cow's milk, this mineral can also sometimes be challenging to obtain from food.

The nutrients found in an egg are distributed fairly evenly between the yolk and the white. This distribution of nutrients is a common characteristic of whole, natural foods and it is one of the reasons that we recommend consumption of whole eggs (except, of course, when only the yolk or the white is called for in a recipe). The chart below explains what approximate percent of the total nutrient amount is found in the yolk and the white of an egg. You will notice that the first four nutrient groupings are those that are found predominately in the egg white, while those that follow are found predominately in the egg yolk (all except for the last nutrient, selenium, which is divided fairly evenly between the egg white and yolk).

Nutrient	Egg White	Egg Yolk
Protein	60%	40%
Magnesium, Potassium, Sodium	10-25%	
Vitamin B3	90%	10%
Vitamin B2	62%	38%
Total Fat	10%	90%
Omega-3 Fats	0%	100%
Vitamins A, D, E, K	0%	100%
Carotenoids	0%	100%
Vitamins B5, B6, B12, Folate, Choline	10% or less	90% or more
Calcium, Phosphorus, Zinc, Copper, Iron	10% or less	90% or more
Manganese	30%	70%

Vitamin B1	25%	75%
Biotin	20%	80%
Selenium	41%	59%

Omega-3 Support

In recent years, there has been a food marketplace trend of greater availability of eggs that are unusually rich in omega-3 fats. These eggs get their high levels of omega-3s through the addition of omega-3 oils to the hen's feed. Oils added to the hen's diet as a way of increasing omega-3s include menhaden oil, krill oil, flaxseed oil, and algae oil. The supplementation of the hen's diet with these oils usually produces as much as 250 milligrams of omega-3s per egg yolk.

What many consumers do not know is that virtually all egg yolks contain omega-3 fats and that by providing hens with a natural, pasture-based diet their omega-3 levels can be naturally increased. Pasture feeding can provide the hen with clover and alfalfa, two examples of legumes that are rich in omega-3s; in fact, pasture feeding can double the amount of omega-3s in an egg yolk. Omega-3s are far too low in the average U.S. diet, and eggs from pasture-raised chickens can provide significant amounts of these anti-inflammatory fats.

Other Health Benefits

As a group, research studies on the health benefits of eggs have shown mixed results. Part of the difficulty that researchers encounter when trying to determine the pros and cons of egg intake is the tendency of participants to consume other foods high in fat and/or saturated fat along with eggs. For example, at breakfast meals in the U.S., eggs are often consumed together with bacon, sausage, or ham. This simultaneous consumption of eggs with other foods can make it difficult for researchers to separate out the specific influence of the eggs. In addition, from a calorie standpoint, two eggs typically provide only 150-175 calories—only 7-8% of a 2,000-calorie diet. This small amount can make it more difficult for researchers to pinpoint the role played by the eggs.

Another complicating factor in egg research is the fiber-free nature of eggs. Since fiber typically has a risk-lowering affect for cardiovascular disease, diabetes, and cancer, egg intake might show up as problematic in a diet that was otherwise very low in fiber, yet helpful in a diet that was otherwise rich in fiber.

These factors described above do not change our view of eggs as an unusually nutrient-rich food that can provide a unique combination of nutrients for a very small number of calories. But they do underscore the importance of integrating eggs into an otherwise healthy meal plan.

In the area of cardiovascular disease, recent studies have shown no increased risk of either heart attack or stroke in conjunction with egg intake of one to six eggs per week. Interestingly, these studies have also shown the ability of egg intake to increase levels of HDL cholesterol (the "good" cholesterol). Not only did egg intake increase the number of HDL molecules, it also improved their composition and allowed them to function more effectively. This improved function may have been the result of more phosphatidylethanolamine being added to the HDL molecules. (The addition of phosphatidylethanolamine, in turn, might have been related to the rich initial choline content of the eggs.)

Not all egg studies show potential cardiovascular benefits, however, and in some studies, egg intake has been related to some increased mortality risk. However, as mentioned previously, it's been difficult for researchers to separate out the possible role of other foods in many studies. Particularly in mortality studies, which often examine diet in very general terms, they are unable to look closely at specific egg amounts in the diet.

One further note about the relationship between egg intake and cardiovascular risk: some persons with type 2 diabetes may be more susceptible to unwanted cardiovascular problems in relationship to egg intake if their type 2 diabetes has also created problems with cholesterol transport through the bloodstream. (These transport problems often correspond to low levels of apolipoprotein E and high levels of apolipoprotein C-III in the blood, which can be determined by lab testing.) Given this connection, persons with type 2 diabetes are encouraged to consult with their healthcare provider when making decisions about eggs in their meal plan.

Like studies on eggs and cardiovascular risk, studies on eggs and cancer risk have been mixed. We have seen large-scale studies in which egg intake was associated with a decreased risk of breast cancer and included along with vegetables, fruits, and legumes as a desirable factor in a risk-lowering meal plan. Yet we have also seen studies in which risk of colon and rectal cancer was increased by egg intake. For us, the mixed nature of these cancer studies underscores the need to consider health benefits of eggs as being conditional upon the overall quality of the diet; we should not be assuming that eggs will automatically lower or raise cancer risk regardless of an overall meal plan.

A Practical Take-Away

We include eggs as one of our WHFoods because of the broad nourishment they provide, their unique combination of nutrients (including omega-3s, antioxidant minerals like selenium, and high biological value protein), and their low calorie cost. Eggs are a nutrient rich, natural, whole food. At the same time, research on eggs has not always shown them to provide health benefits, and in some situations (for example, individuals with type 2 diabetes who are trying to lower their risk of cardiovascular problems) eggs may not be appropriate as part of a routine meal plan. So even though eggs are a natural, nutrient rich whole food, we do not consider them mandatory in any meal plan.

If you do decide to consider the addition of eggs to your meal plan, we encourage you to take a close look at your overall diet. Could it use more protein? If so, eggs might make sense. Does it already have plenty of fiber? If not, it might make more sense to add a fiber-containing food rather than eggs. We're confident that in many diets, pasture-raised eggs can provide key nutrient benefits and lower your disease risk, despite some of the confusion that we've come across in the food science research.

Description

It is common to hear eggs being lumped together with dairy foods and referred to as "eggs and dairy." In fact, we group eggs and dairy foods together this way on our website. It is important, however, to understand how eggs are unique as a food. Chickens—and the eggs laid by female chickens (hens)—belong to the bird class of animals (*Aves*). Hen's eggs are one among many types of bird eggs enjoyed in diets worldwide. Eggs from ducks, geese, quail, turkeys, and ostriches are also part of many cuisines. Birds (including chickens) are omnivores, which means that they eat both meat and plants. Hens, for example, often enjoy eating insects, insect larvae (grubs), and worms. Some of this intake helps explain the unique combination of nutrients found in eggs.

The dairy foods we profile on our website come from cows, which belong to an entirely different class of animals (mammals) than chickens. Unlike hens, cows are herbivores (exclusively plant eating) with a complex digestive system (called a ruminant digestive system) that is designed for lots of chewing and fermentation of grasses, legumes, and other forage plants. Because of their grass-based digestive system, cows provide us with foods (including milk, cheese, yogurt, and beef) that are healthiest when the cows have been grass-fed. However, since hens are birds rather than ruminants and not primarily designed to eat grass (even though hens often do eat grass and enjoy it), we describe eggs on our website as "pastured-raised" instead of "grass-fed."

Chicken eggs are by far the most common type of egg consumed in the U.S., and the breeding of chickens for egg production has resulted in breeds that can lay 200-300 eggs per hen per year. Some of the more popular egg-laying breeds include White Leghorns, Rhode Island Reds, Buff Orpingtons, Golden Coments, Red Sex Links, Isa Browns, Australorps, Black Star, Red Star, Light Sussex, and Plymouth Rock. All of these breeds belong to the same genus, species, and subspecies of animal, namely, *Gallus gallus domesticus*. You may also hear chickens being referred to as "junglefowl," which is a common name for all animals belonging to the *Gallus* genus.

The composition of an egg is usually described as having two basic parts: the white and the yolk. The white is approximately 87% water and 13% protein, and contains both vitamins and minerals. The yolk is about 50% water, 33% fat, and 17% protein; like the white, it also contains both vitamins and minerals. Please see our Health Benefits section for a more detailed description of the nutrients found in each part of the egg.

Egg grading standards are based on the clearness, firmness, and thickness of the white, the presence or absence of defects in the yolk (like blood spots or meat spots), the size of the air cell inside of the shell (the smaller this air space, the higher quality the egg), and the cleanness of the shell, including the absence of any slight breakage. Eggs that score highest on these qualities are graded "AA." Fairly close in quality are "A" eggs. The shelf life of an egg is related to its grade, and a fresh AA egg will have a longer shelf life than a fresh A egg. However, an egg's grade is not the same as its freshness. For more information on egg grading and freshness - including our practical recommendations - please see our How to Select and Store section.

The size of an egg is related to its weight. The chart below provides a summary of the standards used to label eggs as small, medium, large, extra large, or jumbo.

	Average weight per egg (in grams)	**Average weight per egg (in ounces)**
Small	43	1.5
Medium	50	1.75
Large	57	2.0
Extra large	64	2.25

Jumbo	71	2.5

History

As mentioned in our Description section, bird eggs (including chicken eggs) have long held a place in cuisines worldwide. The variety of bird eggs enjoyed in many cultures includes duck, goose, quail, turkey, and ostrich eggs. With respect to their history, it's also worth noting that birds were not the first animals to reproduce by means of shell eggs. Reptiles were the first animals to do that, nearly 150 million years before the first shell eggs produced by birds.

Eggs have always had a primary place in mythologies, religions, and cultural practices worldwide, and have typically been regarded as symbols of rebirth, renewal, beginnings, and fertility. One of the most widely held food and holiday associations is that of the Easter egg. How the egg became associated with this holiday seems to have roots that are both biological and cultural. Before the more modern techniques of poultry raising, hens laid few eggs during the winter. This meant that Easter, occurring with the advent of spring, coincided with the hen's renewed cycle of laying numerous eggs. Additionally, since eggs were traditionally considered a food of luxury, they were forbidden during Lent, so Christians had to wait until Easter to eat them—another reason eggs became associated with this holiday. Interestingly enough, the custom of painting eggshells has an extensive history and was a popular custom among many ancient civilizations, including the Egyptians, Chinese, Greeks, and Persians.

Today, egg production in the U.S. has reached a level of 762 billion eggs per year. About 70% of these eggs are sold and purchased in whole form, and about 30% are removed from shells at "breaker plants" across the country and converted into egg products, including both liquid and dried yolks and whites. Iowa, Ohio, Pennsylvania, Indiana, and California are the country's top five egg-producing states. On a global basis, the U.S. is the largest egg-producing country in the world, followed by Mexico and Brazil. However, small numbers of eggs are produced in most countries worldwide, and out of the world's total (63.7 million tons of hen's eggs), only 20% (12.8 million tons) are produced in all North American, Central American, and South American countries combined.

How to Select and Store

Labeling terms that appear on egg packaging are among the most confusing and misleading for any food type. You might find all of the following terms on the label of an egg carton:

- cage-free
- free-range
- free roaming
- pastured
- pasture-raised
- organic
- omega-3
- omega-3 enriched

Unfortunately, while legal, some of these labeling terms are also misleading. The term "free-range," for example, means that the hens who lay the eggs must have access to the outdoors—but the emphasis here is on "access." No standards are set for how often the hens actually go outside, how much time they must stay outside if they do go out, or what the outdoor environment must include in terms of total space or vegetation. "Pastured" and "pasture-raised" are similarly misleading terms that are not backed up by standards for actual time spent by hens in a pasture setting or standards for qualifying an outdoor space as "pasture." Use of the term "cage-free" on the label of an egg carton means what it says—but legal use of this term does not require hens to have any access to outdoor space and therefore may be used when hens have been confined indoors full-time.

When an egg carton displays the USDA organic logo, you still cannot be certain that chickens have spent much time outdoors. Organic standards for eggs do require outdoor access for hens, but the exact standards for outdoor access are not well defined. For example, no minimal amount of days spent outdoors or time per day spent outdoors is specified. Organic standards require strict feeding with certified organic feed, but legal use of the organic label does not require any fixed amount of feed to be obtained from a pasture setting. These limitations of the organic logo are one more reason that we encourage you to talk with your grocer or egg producer and find out how the chickens were actually raised.

Another confusing aspects of egg selection is deciding about an egg's freshness *before* you purchase it. Unfortunately, the labeling on an egg carton cannot help you make a clear decision about freshness. An expiration date for the eggs is usually stamped on the side of the carton, often with the abbreviation "EXP" (e.g., EXP Jan23) However, this expiration date is calculated from the time of packaging not from the time when the egg was laid by the hen. (Thirty days is the maximum amount of time allowed between the packing date and the expiration date.) Since you would want to know time from egg laying in order to determine freshness, the expiration date cannot help you here as much as you would like.

As presented in more detail in our Description section, eggs that score highest on certain qualities are graded "AA." Fairly close in quality are "A" eggs. The shelf life of an egg is related to its grade, and a fresh AA egg will have a longer shelf life than a fresh A egg. In and of itself, however, a grade of AA does not tell you that an egg is fresh, since the egg grading system does not take the time of laying into account. If an AA egg is fresh, it will stay fresh longer than an A egg. But this benefit of an AA egg still does not tell us whether an AA egg is fresh in the first place.

Because of these limitations in the grading system and expiration date assignment for eggs, we recommend that you talk either with your grocer (depending on his or her knowledge of the situation) or the farm itself to determine the freshness of your eggs. In some situations, there may only be several days between the laying of an egg and its appearance in the dairy section of your grocery. In other situations, there might be three weeks or more. As we have discussed previously in this profile, another alternative is to purchase eggs directly from a small local farm that sells to consumers.

Although it is possible to detect some aspects of egg safety from visual inspection of an egg and evaluation of its odor, in the key area for egg safety—contamination of an egg with *Salmonella enteritidis* (SE) bacteria—our sense of sight and smell are of no help whatsoever in determining the likelihood of SE contamination. While SE bacteria are larger than viruses, they are still invisible to the naked eye and cannot be seen without a microscope. The steps used by public health agencies for detecting the presence of SE in eggs or hen houses are complicated and involve complicated lab techniques. Gene typing, antibiotic susceptibility testing, culture methods, and biochemical marker testing are basic methods used to determine the presence of SE. Here are some factors to look for when inspecting an egg, and their relationship to egg safety:

- Cloudiness of egg whites: The white of a fresh egg is naturally cloudy. This cloudiness is mostly due to presence of dissolved carbon dioxide and the suspension of albumen proteins in the watery liquid that forms the white. As an egg ages, carbon dioxide will escape through pores in the shell and the white will may also become less acidic. These changes are typically associated with a clearing of the white and less cloudy appearance. The bottom line: you can generally use the cloudiness of the egg white to help confirm freshness, with cloudy whites indicating fresh eggs. But degree of cloudiness has no relationship to SE contamination. Since we recommend consumption of eggs that are as fresh as possible, we encourage you to look for egg whites that are cloudy in appearance.
- Yolk firmness and color: Yolk color is mostly related to the hen's diet. If the hen eats more pigmented plants (for example, the petals of flowers with orange or yellow pigments or yellow corn), the yolk will typically be darker and richer in color. By contrast, if the hen eats large amounts of white corn in her feed, the yolk will be less colorful. Like the white of an egg, its yolk will undergo changes as it ages. Over time, the yolk membrane will weaken, and the yolk will become flatter. Once again, these features can help you confirm an egg's degree of freshness but they are not related to the presence or absence of SE. We recommend eating eggs from pasture-raised hens, and the yolks of those eggs are more likely to be richer in color from the natural diversity of pasture plants.
- Red blood spots on the yolk: These spots are caused by the breaking of a blood vessel along the surface of the yolk. This type of breakage can occur naturally and is not a sign of contamination. We are not aware of any research showing safety risks from cooked eggs with blood spots.
- Pinkish egg whites: If the egg white has a pinkish color, it is usually a sign of bacterial spoilage, and the bacterium most often involved is *Pseudomonas*. While other spoilage bacteria like coliform or *Flavobacterium* can play a role in egg white discoloration, pinkish egg whites are not a sign of SE. You should discard eggs if you find pinkish whites inside.
- Off odors: Many different types of spoilage bacteria will produce off-odors in eggs. These off odors may be sulfur-like, or they might simply just smell "bad." Off odors from an egg cannot be used, however, to help determine the presence or absence of SE. But despite the lack of a relationship between a bad smelling egg and SE, we recommend that you discard all eggs with off odors due to a variety of unwanted qualities.

In summary, most visible characteristics of an egg are related to freshness, the breed of the hen and her genetics, and her diet. None of these characteristics can help you determine the presence or absence of SE. That's why it is so important to find very high-quality small local farms or very high quality larger scale egg producers when trying to minimize your risk of exposure to SE contaminated eggs.

Inspect any eggs that you purchase for breaks or cracks. And of course, take care when packing them in your shopping bag for the trip home as they are very fragile.

Always store eggs in the refrigerator. Although eggs will often be safe to consume after the expiration date on the egg carton, we nevertheless recommend consumption of eggs by the designated expiration date for optimal safety and better freshness. When refrigerating eggs, do not wash them as this can remove their protective coating. Keep them in their original carton or in a covered container so that they do not absorb odors or lose any moisture. Do not store them in the refrigerator door since this exposes them to too much heat each time the refrigerator is opened and closed. Make sure to store them with their pointed end facing downward as this will help to prevent the air chamber, and the yolk, from being displaced.

How to Enjoy

A Few Quick Serving Ideas

- Hard-boiled eggs are fun to eat and easy to pack for on-the-go lunches.
- Mix chopped up hard-boiled eggs with fresh lemon juice and olive oil, leeks and dill (and salt and pepper to taste) to make a healthy egg salad.
- Instead of Eggs Benedict, make Eggs "Buenodict." Place a poached egg on top of a whole grain English muffin lined with steamed spinach. Top with salsa or any of your favorite seasonings and enjoy.
- Say olé to the day with a huevos ranchero breakfast. Add chili peppers to scrambled eggs and serve with black beans and corn tortillas.

For some of our favorite recipes, click Recipes.

Safety

Eggs and Food Allergies

Eggs are among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions.

Handling of Eggs

Health safety concerns about eggs center on salmonellosis (salmonella-caused food poisoning). Salmonella bacteria from the chicken's intestines may be found even in clean, uncracked eggs. You'll find these issues discussed in detail in our Q & A about raw versus cooked eggs. As a general rule, there is more risk associated with soft cooked and "sunny side up" eggs than eggs that have been hard boiled, scrambled, or poached.

Dishes and utensils used when preparing eggs should be washed in warm water separately from other kitchenware, and hand washing with warm, soapy water is essential after handling eggs. Any surfaces that might have potentially come into contact with raw egg should be washed and can be sanitized with a solution of 1 teaspoon chlorine to 1 quart water.

Risk of Biotin Deficiency

Raw egg whites contain a glycoprotein called avidin. Avidin has a unique preference for binding together with one particular B vitamin—biotin—and when it does, an avidin-biotin complex is formed that is unable to be absorbed from our digestive tract. As a result, we do not get the biotin nourishment that we would otherwise get from the food. Hen's eggs average about 10 micrograms of biotin. Two micrograms are found in the white (where the avidin glycoprotein is also located), and 8 micrograms are found in the yolk. Since cooking is able to denature the avidin glycoprotein in an egg white, cooking also makes this glycoprotein unable to bind together with biotin in either the white or the yolk and prevent its absorption. The Daily Value (DV) for biotin is 300 micrograms, and since the total amount of biotin in one egg is only 10 micrograms, it would not be logical for a person to depend on his or her egg intake to meet the biotin DV. However, loss of biotin nourishment from an egg could still be prevented through cooking, based on food science research in this area.

Other Controversies

Some animal foods and some plants foods have been the subject of ongoing controversy that extends well beyond the scope of food, nutrient-richness, and personal health. This controversy often involves environmental issues, or issues related to the natural lifestyle of animals or to the native habitat for plants. Eggs has been a topic of ongoing controversy in this regard. Our Controversial Foods Q & A will provide you with more detailed information about these issues.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Eggs, pasture-raised, large, hard boiled
1.00 each
50.00 grams

Calories: 78
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
choline	146.90 mg	35	8.0	excellent
selenium	15.40 mcg	28	6.5	very good
biotin	8.00 mcg	27	6.2	very good
vitamin B12	0.55 mcg	23	5.3	very good
vitamin B2	0.26 mg	20	4.6	very good
molybdenum	8.50 mcg	19	4.4	very good
iodine	27.00 mcg	18	4.2	very good
pantothenic acid	0.70 mg	14	3.3	good
protein	6.29 g	13	2.9	good
phosphorus	86.00 mg	12	2.9	good
vitamin D	43.50 IU	11	2.5	good
vitamin A	74.50 mcg RAE	8	1.9	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Yogurt, grass-fed

Many types of yogurt are part of cuisines throughout the world. At WHFoods, we focus on yogurt that is made from the milk of grass-fed dairy cows. However, if you are interested in other types of yogurts, for example, non-dairy yogurts made from soy or coconut milk, you may want to go directly to our Description section for yogurt. This section also includes information about Greek style yogurt. If you are particularly interested in yogurt as a probiotic food, you may want to go directly to our Health Benefits section.

Grass-fed yogurt is a relatively new food in the U.S. marketplace, and grass feeding is a practice not yet familiar to all consumers. By definition, 100% grass-fed yogurt comes from cows who have grazed in pasture year-round rather than being fed a processed diet for much of their life. Grass feeding improves the quality of yogurt and makes the yogurt richer in omega-3 fats and CLA, a beneficial fatty acid named conjugated linoleic acid. (For more detailed information about grass feeding, please click here.) Just how important is grass feeding for yogurt quality? As you will see in the chart below, we have included grass-feeding as one of our top-level recommendations for anyone who plans to include yogurt in their meal plan:

Shopping for Yogurt	
Stick with organic	Organic standards help lower risk of contaminated feed and organic yogurt usually has higher nutrient quality. However, remember that organic by itself does not guarantee a natural lifestyle for the dairy cows.
Ask for 100% grass-fed	Go beyond organic by asking for 100% grass-fed. Don't get sidetracked by the confusing array of labeling terms like natural" or "pasture-raised." Labeling laws allow products to display these terms even if dairy cows spend little or no time outdoors in a pasture setting. Unfortunately, even the term "grass-fed" is not sufficient since grass-fed dairy cows may have spent a relatively small amount of time grass feeding. The standard to look for on the label is "100% grass-fed." Talk to your grocer or the dairy cow farmer and find out how the animals were actually raised. In addition, if you would like more information about the practice of grass-feeding, please click here.
Consider local farms	Organic, 100% grass-fed cheese may be available from local farms with small flocks, which provide a natural lifestyle for their dairy cows. Two websites that can help you find small local farms in your area are www.localharvest.org and www.eatwild.com. Both sites are searchable by zip code.

One final note about grass-fed yogurt: while this food is becoming more and more popular in the marketplace and is being carried by numerous whole food groceries across the country, small local dairies that are pasture-focused can be a very good source for grass-fed yogurt. One website that can help you find local grass-fed dairies in your area is www.eatwild.com. On this website, you can find a map of the United States which allows you to click on your state and find local dairies that are pasture-focused and engage in yogurt production.

What's New and Beneficial About Grass-Fed Yogurt

- Because grass feeding of cows can increase the healthfulness of fats in their body, milk from those cows can be a source of high-quality fats for making yogurt. Lactic acid bacteria used to ferment milk into yogurt have now been shown to take some of its fatty acids and convert them into conjugated linoleic acid (CLA). A fairly conservative estimate of the CLA in grass-fed yogurt would be about 8 milligrams per liquid ounce. Research is linking our CLA intake to decreased risk of many health problems, including heart attack, blood sugar imbalance, excessive inflammation, and loss of bone mass. One of the reasons we generally recommend grass-fed yogurts from whole milk is that nonfat and skim-milk yogurts—while still healthy in many ways—cannot naturally provide this same level of CLA or other high-quality fats like the omega-3s found in most whole milk yogurts.
- Yogurt has recently been show to lower risk of type 2 diabetes in several large-scale human studies. While the greatest risk reduction has been shown in individuals who average about 6 ounces per day, even 3 ounces per day has been shown to decrease risk. While a variety of different factors might be involved in this health benefit, improved digestive function is undoubtedly high on the list. Repeated studies on live culture yogurts show the ability of yogurt to help regulate the steadiness of food passage through our digestive tract, and to support the digestion and absorption of food through increased metabolism by healthy bacteria in the gut. Steadiness and hardiness of digestion are very important for healthy blood sugar regulation since they help prevent both too quick digestion and release of sugars from food as well as too slow digestion of food that might cause unwanted dips in blood sugar in the hours following a meal.
- Probiotic yogurts (containing millions or tens of millions of live bacteria per gram of yogurt) have been found to decrease total blood cholesterol levels while increasing HDL ("good cholesterol") levels in a recent study on Iranian women. Women in the study consumed about 10 ounces of yogurt each day over the course of 6 weeks. Interestingly, the

authors of this study speculated about the potentially important role of sphingolipids in promoting better levels of cholesterol. Sphigolipids—including sphingosine, sphinganine, and sphingomyelin—are naturally occurring fats in yogurt and other foods; researchers now know that they play a key role in cell signaling and promotion of health in numerous body systems, including the cardiovascular system.

- A recent study from India has shown a protective effect for yogurt intake on the risk of hip fracture. In this study, the amount of yogurt most closely associated with decreased risk was at least 2 cups per week. (Along with intake of yogurt, exercise, adequate calcium and vitamin D intake, and avoidance of caffeinated beverages like caffeinated coffee or tea were also associated with decreased fracture risk.)

Yogurt, grass fed, whole milk
1.00 cup
(245.00 grams)

Calories: 149
GI: low

Nutrient	DRI/DV
iodine	47%
vitamin B12	38%
phosphorus	33%
calcium	30%
vitamin B2	27%
molybdenum	25%
pantothenic acid	19%
protein	17%
biotin	13%
zinc	13%

Health Benefits

Probiotic support

"Probiotic" is a term used to describe foods and supplements that contain living micro-organisms. Bacteria are by far the most common type of micro-organism found in probiotics, but there are some probiotic supplements in the marketplace that are yeast-based.

While most commercially sold yogurts contain some living bacteria and might very loosely be referred to as "probiotic" for this reason, it's definitely incorrect to think about all yogurts as being equivalent in terms of their probiotic benefits. For example, some yogurts in the marketplace may contain less than 1,000 bacteria per gram. While that number might sound large, it's actually quite small when you are talking about bacteria. While there are no required industry standards for labeling a yogurt as "probiotic," a commonly adopted voluntary standard in the industry is at least 1,000,000 living bacteria per gram of yogurt.

Since measurement of living versus dead bacteria in a yogurt can be complicated, most companies also report the live bacteria content of their yogurt in terms of "cfu" or "colony forming units. CFUs are best thought of as viable bacterial cells that capable of multiplying and forming larger colonies of bacteria. It's also worth noting here that in scientific notation, the number one million (1,000,000) is typically written as 10^6. So you might see a phrase like "10^6 CFUs" on package information about yogurt. This phrase tells you that the yogurt contained at least 1,000,000 viable bacterial cells at the time when it was manufactured. The National Yogurt Association (NYA) has adopted this 10^6 CFU standard for any fresh yogurt displaying its "Live and Active Cultures" (LAC) seal.

Since the NYA program is voluntary, many yogurt manufacturers choose to provide direct information about live bacterial cultures on product labels instead of displaying an LAC seal. (Of course, some manufacturers do both.) For this reason, it's common to see phrases like "live probiotic cultures," "live cultures," "active cultures," or "probiotic cultures" on yogurt packaging. In research studies on yogurt, we've seen yogurts that contain as many as 10^9 CFUs per gram, which means one billion viable bacterial cells per gram of yogurt.

The specific types of bacteria found in yogurt vary from manufacturer to manufacturer. However, some species are used much more commonly than others. Starter cultures used to begin the yogurt fermentation process rely on lactic acid bacteria like *Lactobacillus* and Streptococcus to convert lactose (milk sugar) into lactic acid. (The increased acidity helps proteins in the milk coagulate and bring more thickness to the yogurt.) Later on in the yogurt production process, additional bacteria may be added; one common type used at this stage of production is *Bifidobacterium*.

Most of the research on live culture yogurts shows the ability of live bacteria in yogurt to become metabolically active in our digestive tract and to support digestion and absorption of nutrients. Consumption of probiotic yogurts has also been show to help steady the passage of food through our digestive tract and to lessen the risk of certain digestive problems (such as diarrhea). Studies have also shown the ability of yogurt bacteria to convert food sugars found inside our digestive tract into short chain fatty acids (SCFAs). These SCFAs can then be used as an energy source for cells that line our large intestine, providing better function in that part of our digestive tract.

Even before the yogurt is consumed, live cultures may set the stage for health benefits by transforming the nutrient content of the yogurt itself. For example, while you're likely to get 5-6 grams of lactose (milk sugar) in one half cup of grass-fed cow's milk, one half cup of grass-fed yogurt is likely to provide you with only 3-4 grams due to the breakdown of lactose by live bacteria in the yogurt.

If digestive benefits are among your top reasons for considering inclusion of yogurt in your meal plan, we recommend selection of yogurts clearly labeled to have one million or more active bacterial cultures (CFUs). However, we also believe that grass-fed, cow's milk yogurt can provide you with important health benefits even if the amount of active bacteria in the yogurt is much smaller.

Blood Sugar Benefits

The combination of strong protein content with live bacterial cultures makes yogurt a food with blood sugar benefits, even though it is a food lacking in fiber. (Most diets focused on better blood sugar balance emphasize the importance of high-fiber foods that help regulate the pace of digestion and prevent too quick digestion and release of food sugars.) Protein is an ideal nutrient for blood sugar support because it digests at a moderate rate and is associated with better regulation of appetite. As a good source of protein, yogurt makes sense as a food that would provide blood sugar benefits. While the lack of fiber might be expected to be a drawback for yogurt in its potential for supporting blood sugar, this lack of fiber appears to be offset by the presence of live bacteria in yogurt. These live bacteria—especially in probiotic yogurts containing at least millions (10^6) of live bacteria per gram—have the ability to take food sugars found inside our digestive tract (not only sugars directly contained in the yogurt but any sugars that are present in the digestive tract) and convert them into short chain fatty acids (SCFAs). These SCFAs can then be used as an energy source for cells that line our large intestine, providing better function in that part of our digestive tract. At the same time, these sugars become unavailable for absorption and cannot trigger any unwanted spike in our blood sugar.

Broad Nutrient Support

It's important to recognize the diverse range of nutrients provided by grass-fed yogurt. With the exception of dietary fiber, virtually all key nutrient groups are represented in the nutritional profile of grass-fed yogurt. We're talking about all B-vitamins, most key minerals, proteins with the vast majority of amino acids in good supply, high-quality fats like omega-3s and CLA, and also phytonutrients like sphingosine and sphinganine. In addition to this nutrient diversity, yogurts with a sufficient number of live bacterial cultures ("probiotic" yogurts) can provide us with an even greater nutritional diversity because their bacteria can continue to metabolize food and transform nutrients after the yogurt has been consumed. It's worth remembering that yogurt is similar to all traditionally fermented foods in this respect: it belongs to a group of foods that are especially diverse in nutrient content.

Other Benefits

We've seen preliminary studies connecting yogurt intake with decreased appetite (which does not surprise us, given the protein-rich nature of this food), better immune system function, and better bone support. In one small-scale study with HIV-positive women, 4 ounces of live culture yogurt per day over a month's period of time was able to decrease digestive and vaginal problems. In several studies on dairy products and bone health, fermented dairy products like yogurt have been shown to decrease bone risk.

Studies on yogurt intake and cancer risk have been mixed. There has been a good bit of speculation about the presence of insulin-like growth factor (IGF-1 and IGF-2) in cow's milk and the role it might play in increased cancer risk, but we have nevertheless seen studies showing protective effects for certain cancers from intake of yogurt. We have also seen a study showing decreased risk of bladder cancer in association with yogurt intake of 2 or more servings per day (the serving size was not specified), even though this same study showed no protective effect from either cheese or overall dairy intake.

With respect to these other broad areas of potential health benefit, we suspect that the impact of yogurt on the digestive tract may play a key role. Digestion can be a highly individual process, and individuals who do well on yogurt and find it to be a food that improves their digestive tract health may be the same individuals who derive other important health benefits as well. But we also look forward to additional research in these other areas of potential health benefit.

Description

Dairy and Non-Dairy Yogurt

Yogurt can be made from either animal or plant foods. Animal-based yogurts are often referred to as "dairy" yogurts and plant-based yogurts as "non-dairy" yogurts. Dairy yogurts can be made from virtually any type of milk including cow's milk, sheep's milk, and goat's milk. Soy milk and coconut milk yogurts are non-dairy products that have also become popular. As a general rule, non-dairy yogurts are less concentrated in protein than dairy yogurts but contain more fiber. Live bacterial cultures can be present in equivalent amounts in both dairy and non-dairy yogurts, depending on the fermentation and production process used by the manufacturer. In the case of soy milk, it's worth noting here that not all manufacturers use traditional fermentation processes or produce soy yogurts containing live bacterial cultures. For example, some soy yogurts are made by blending tofu with other ingredients, yet never subjecting the mixture to a bacterial fermentation process.

While we profile grass-fed yogurt from cow's milk on our website, we recognize that some people may prefer non-dairy yogurts and we believe that these types of yogurts can also provide health benefits. If you decide to include soy milk yogurt, coconut milk yogurt, or other non-dairy yogurts in your meal plan, we believe that your best health benefits are most likely to come from products that have been fermented and that contain live bacterial cultures.

Greek Style Yogurt

Approximately 4 billion pounds of yogurt are manufactured in the U.S. each year, and about 35% is now produced and consumed in the form of Greek style yogurt. Greek style yogurt is essentially strained yogurt. When made according to traditional methods, Greek style yogurt begins with traditional fermentation of yogurt and after the fermentation process is completed, the yogurt is strained using filters and sometimes spinning to remove a significant portion of the watery whey. The result is a thicker and creamier yogurt.

Unlike the name suggests, Greek style yogurt is not a food that originated specifically in Greece. It was originally enjoyed throughout the Middle East and is sometimes referred to in Arabic as *laban* or *labneh*. Although Greek style yogurt in the U.S. is almost always purchased in fresh liquid, many Middle Eastern countries also have a tradition of drying strained yogurt so that it can be more easily stored and transported. Sheep milk, goat milk, and camel milk are common sources for strained yogurt in the Middle East.

Most U.S. groceries offer Greek style yogurt in whole, low-fat, and non-fat versions. Non-fat Greek style yogurt is unique in its ability to provide more concentrated protein than any other type of yogurt. It's not unusual to get 12-13 grams of protein in just 4 ounces of non-fat Greek style yogurt. By comparison, 4 ounces of whole milk Greek style yogurt is likely to provide you with about 7-8 grams of protein in 4 ounces, while 4 ounces of non-Greek style, whole milk yogurt offers about 6-7 grams. While all of these yogurts provide you with a valuable amount of protein, non-fat Greek style yogurt is recommended if your primary goal is to maximize the protein content of your yogurt.

One final note about Greek style yogurt: not all of it is made according to traditional fermentation and straining techniques. Due to the rapid growth in popularity of this yogurt type, some manufacturers are working to meet the marketplace need by taking tapioca or other thickeners and adding them to non-strained yogurt, together with supplemental protein in order to match the amount in traditionally strained Greek style yogurt. While these "no-strain" Greek style yogurts may match traditional Greek style yogurts in texture and protein content, we consider them to be a further step away from whole, natural food and recommend traditionally fermented and strained products when choosing Greek yogurt.

Basics of Yogurt Making

The simplest of yogurt-making processes involve nothing more than milk, heat, and what is called a "starter culture." Starter cultures typically contain lactic acid bacteria (LAB) and often specifically include *Lactobacillus bulgaricus* and *Streptococcus thermophiles*. After the milk is heated to a temperature of approximately 180°F and then allowed to cool to approximately 110°F, the starter culture is added and the mixture is kept for another 3-5 hours at the same constant low temperature (110°F). This initial 3-5 hour period of time is referred to as "incubation." At the end of the incubation period, the yogurt is refrigerated and then ready for eating.

The basics of yogurt making are simple enough for you to accomplish at home. Thanks to the National Center for Home Food Preservation—a website put together by researchers and educators at university extension services throughout the U.S. together with the help of the U.S. Department of Agriculture—we have posted easy-to-follow homemade yogurt information on our website. We have posted that that information here. You can also visit the website of the National Center for Home Food Preservation at http://nchfp.uga.edu/.

History

Yogurt making appears to have originated in the Middle East and Central Asia, even though researchers have been unable to pin down the exact time frame for this development. Camels, sheep, goats, and other animals were the primary sources of milk for yogurt since cows had yet to be domesticated. (In North America, buffalo and bison milk are two further examples of animal milks used to make yogurt prior to the domestication of cows.) Many cultures also developed techniques for drying their liquid yogurt so that it had a longer shelf life and could be more easily stored and transported. It became very common for certain nomadic cultures to rely on dried yogurt as part of their staple food.

Today, cow's milk has become the primary source for commercially produced yogurt, and this food is enjoyed in fresh liquid form worldwide. Yogurt consumption in the U.S. is about 4 times greater than it was in the 1980's, and averages about 11-12 pounds per person per year. (This amount is much smaller than would be found in other parts of the world. For example, in Europe, yogurt consumption averages closer to 65-70 pounds per person). Nearly 4 billion pounds of yogurt are manufactured annually in the U.S. each year, and due to the increasing popularity of Greek-style yogurt, nearly 1.5 billion pounds are manufactured in that form.

As sources of grass-fed yogurt, small local dairies have become increasingly popular across the U.S. One website that can help you find local grass-fed dairies in your area is www.eatwild.com. On this website, you can find a map of the United States that allows you to click on your state and find local dairies that are pasture-focused and engage in yogurt production.

How to Select and Store

In addition to Shopping For Yogurt chart presented at the beginning of this profile, we'd like to give you some additional suggestions about yogurt selection. First, it is not necessary to purchase a non-pasteurized, raw milk yogurt if you want to obtain live bacterial cultures. Most manufacturers add live cultures to their yogurt after the milk has been pasteurized. Second, it is also not necessary to select a Greek style yogurt in order to get full health benefits. As we have indicated in our Shopping For Yogurt chart, grass feeding and organic certification are the key factors here. However, if Greek style yogurt is your favorite, we encourage you to enjoy it without reservation! Just look for organic, grass-fed Greek style yogurt either in a whole foods grocery or at a local pasture-based dairy farm.

Check the expiration date on the side of the yogurt container to make sure that it is still fresh. Shelf life is especially important for fresh, live culture yogurt if you want to enjoy optimal health benefits, so it's definitely worthwhile to respect the expiration dates. Avoid yogurts that have artificial colors, flavorings, or sweeteners. Additionally, while fruit-filled yogurt can be a delicious treat, be aware that oftentimes these yogurt products contain excess sugar. We recommend the purchase of plain yogurts for this reason, with the addition of fresh fruits or other foods to the yogurt at home as desired.

Store yogurt in the refrigerator in its original container. To get the full health benefits from your yogurt—including the live culture benefits—observe the yogurt's expiration date and discard or compost if it has expired.

It's also worth remembering that yogurt making is not a difficult process and simple enough for you to accomplish at home. Thanks to the National Center for Home Food Preservation—a website put together by researchers and educators at university extension services throughout the U.S. together with the help of the U.S. Department of Agriculture—we have posted easy-to-follow homemade yogurt information on our website. You can go directly to that information by clicking here. You can also visit the website of the National Center for Home Food Preservation at http://nchfp.uga.edu/.

How to Enjoy

A Few Quick Serving Ideas

- Toss cubes of cooked eggplant with plain yogurt, chopped mint leaves, garlic and cayenne.
- Add chopped cucumber and dill weed to plain yogurt. Eat this delicious and cooling salad as is or use as an accompaniment to grilled chicken or lamb.

- Yogurt parfaits are a visual as well as delicious treat. In a large wine glass, alternate layers of yogurt and your favorite fruits.
- Yogurt is a great base for salad dressings. Simply place plain yogurt in the blender with enough water to achieve your desired consistency. Add to this your favorite herbs and spices.
- Mix cold cereal or granola with yogurt for a twist on the traditional cereal and milk breakfast.

For some of our favorite recipes, click Recipes.

Safety

Yogurt and Adverse Reactions

Milk and the foods made from it, including yogurt, are among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. Some people also have an intolerance to yogurt owing to the lactose sugar that it contains. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions

Production and Processing of Yogurt

Nationally marketed yogurts are typically made from homogenized and pasteurized milks. Even though live cultures are typically added to yogurt after the pasteurization process (avoiding destruction of helpful bacteria during pasteurization), questions have still been raised by consumers and scientists about the production and processing of cow's milk that is used in manufacture of yogurt. We've created in-depth Q & As in the areas of milk homogenization and milk pasteurization.

Other Controversies

Some animal foods and some plants foods have been the subject of ongoing controversy that extends well beyond the scope of food, nutrient-richness, and personal health. This controversy often involves environmental issues, or issues related to the natural lifestyle of animals or to the native habitat for plants. Yogurt has been a topic of ongoing controversy in this regard. Our Controversial Foods Q & A will provide you with more detailed information about these issues.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Yogurt, grass fed, whole milk 1.00 cup 245.00 grams				**Calories: 149 GI: low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
iodine	71.05 mcg	47	5.7	very good
vitamin B12	0.91 mcg	38	4.6	very good
phosphorus	232.75 mg	33	4.0	very good
calcium	296.45 mg	30	3.6	very good
vitamin B2	0.35 mg	27	3.2	good
molybdenum	11.27 mcg	25	3.0	good
pantothenic acid	0.95 mg	19	2.3	good
protein	8.50 g	17	2.0	good
zinc	1.45 mg	13	1.6	good
biotin	3.92 mcg	13	1.6	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Barley

Barley is a wonderfully versatile cereal grain with a rich nutlike flavor and an appealing chewy, pasta-like consistency. Its appearance resembles wheat berries, although it is slightly lighter in color. Sprouted barley is naturally high in maltose, a sugar that serves as the basis for both malt syrup sweetener. When fermented, barley is used as an ingredient in beer and other alcoholic beverages.

Barley, hulled, dry
0.33 cup
(61.33 grams)

Calories: 217
GI: low

Nutrient	DRI/DV
manganese	60%
molybdenum	60%
selenium	42%
fiber	42%
copper	34%
vitamin B1	33%
chromium	23%
phosphorus	23%
magnesium	20%
vitamin B3	18%

Health Benefits

When the weather's cold, a big pot of soup simmering on the stove warms the heart as well as the hearth. Adding some whole grain barley to the pot will improve your health along with the flavor of whatever soup or stew you're cooking. In addition to its robust flavor, barley's claim to nutritional fame is based on its being a very good source of molybdenum, manganese, dietary fiber, and selenium, and a good source of copper, vitamin B1, chromium, phosphorus, magnesium, and niacin.

Barley's Fiber for Regularity, Lower Cholesterol, & Intestinal Protection

Wish you were more regular? Let barley give your intestinal health a boost. In addition to providing bulk and decreasing the transit time of fecal matter, thus decreasing the risk of colon cancer and hemorrhoids, barley's dietary fiber also provides food for the "friendly" bacteria in the large intestine. When these helpful bacteria ferment barley's insoluble fiber, they produce a short-chain fatty acid called *butyric acid*, which serves as the primary fuel for the cells of the large intestine and helps maintain a healthy colon. These helpful bacteria also create two other short-chain fatty acids, *propionic* and *acetic acid*, which are used as fuel by the cells of the liver and muscles.

The *propionic acid* produced from barley's insoluble fiber may also be partly responsible for the cholesterol-lowering properties of fiber. In animal studies, *propionic acid* has been shown to inhibit *HMG-CoA reductase*, an enzyme involved in the production of cholesterol by the liver. By lowering the activity of this enzyme, *propionic acid* helps lower blood cholesterol levels.

In addition, barley's dietary fiber is high in *beta glucan*, which helps to lower cholesterol by binding to bile acids and removing them from the body via the feces. Bile acids are compounds used to digest fat that are manufactured by the liver from cholesterol. When they are excreted along with barley's fiber, the liver must manufacture new bile acids and uses up more cholesterol, thus lowering the amount of cholesterol in circulation. Soluble fiber may also reduce the amount of cholesterol manufactured by the liver.

A study published in the *American Journal of Clinical Nutrition* suggests barley's fiber has multiple beneficial effects on cholesterol. In this study of 25 individuals with high cholesterol (postmenopausal women, premenopausal women, and men), adding barley to the American Heart Association Step 1 diet resulted in a significant lowering in total cholesterol in all subjects, plus their amount of large LDL and large and intermediate HDL fractions (which are considered less atherogenic) increased, and the smaller LDL and VLDL cholesterol (the most dangerous fractions) greatly decreased.

Lastly, when barley provides insoluble fibers that feed friendly bacteria in the digestive tract, this helps to maintain larger populations of friendly bacteria. In addition to producing the helpful short-chain fatty acids described above, friendly bacteria play an important protective role by crowding out pathogenic (disease-causing) bacteria and preventing them from surviving in the intestinal tract.

Barley's fiber can prevent or help with a number of different conditions. For example, when barley's fiber binds to and removes cholesterol-containing bile, this can be very beneficial for people struggling with heart disease since it forces the body to make more bile by breaking down cholesterol, thus lowering cholesterol levels.

A study published in the *Archives of Internal Medicine* confirms that eating high fiber foods, such as barley, helps prevent heart disease. Almost 10,000 American adults participated in this study and were followed for 19 years. People eating the most fiber, 21 grams per day, had 12% less coronary heart disease (CHD) and 11% less cardiovascular disease (CVD) compared to those eating the least, 5 grams daily. Those eating the most water-soluble dietary fiber fared even better with a 15% reduction in risk of CHD and a 10% risk reduction in CVD.

The fiber in barley can also help to prevent blood sugar levels from rising too high in people with diabetes.

Additional Protection Against Atherosclerosis

Yet another reason to increase your intake of barley is that, in addition to its fiber, barley is also a good source of niacin, a B vitamin that provides numerous protective actions against cardiovascular risk factors. Niacin can help reduce total cholesterol and *lipoprotein (a)* levels. (*Lipoprotein (a)* or Lp(a) is a molecule composed of protein and fat that is found in blood plasma and is very similar to LDL cholesterol, but is even more dangerous as it has an additional molecule of adhesive protein called *apolioprotein (a)*, which renders Lp(a) more capable of attaching to blood vessel walls.)

Niacin may also help prevent free radicals from oxidizing LDL, which only becomes potentially harmful to blood vessel walls after oxidation. Lastly, niacin can help reduce platelet aggregation, the clumping together of platelets that can result in the formation of blood clots. One cup of barley will supply you with 14.2% of the daily value for niacin.

Significant Cardiovascular Benefits for Postmenopausal Women

Eating a serving of whole grains, such as barley, at least 6 times each week is a good idea, especially for postmenopausal women with high cholesterol, high blood pressure or other signs of cardiovascular disease (CVD).

A 3-year prospective study of over 220 postmenopausal women with CVD, published in the *American Heart Journal*, shows that those eating at least 6 servings of whole grains each week experienced both:

- Slowed progression of atherosclerosis, the build-up of plaque that narrows the vessels through which blood flows, and
- Less progression in stenosis, the narrowing of the diameter of arterial passageways.

The women's intake of fiber from fruits, vegetables and refined grains was *not* associated with a lessening in CVD progression.

The 2005 Dietary Guidelines for Americans recommends at least 3 servings of whole-grain foods each day, but experts say most Americans eat less than a single serving. Don't be part of this majority! For delicious ideas that can help you enjoy whole grains as a daily part of your "Healthiest Way of Eating," see the "How to Enjoy" section below and take a look at the other World's Healthiest Foods ideas for whole grains by clicking buckwheat, corn, millet, quinoa, brown rice, rye, spelt, whole wheat.

Prevent Heart Failure with a Whole Grains Breakfast

Heart failure is the leading cause of hospitalization among the elderly in the United States. Success of drug treatment is only partial (ACE inhibitors and beta-blockers are typically used; no evidence has found statins safe or effective for heart failure), and its prognosis remains poor. Follow up of 2445 discharged hospital patients with heart failure revealed that 37.3% died during the first year, and 78.5% died within 5 years.

Since consumption of whole grain products and dietary fiber has been shown to reduce the risk of high blood pressure and heart attack, Harvard researchers decided to look at the effects of cereal consumption on heart failure risk and followed 21,376 participants in the Physicians Health Study over a period of 19.6 years.

After adjusting for confounding factors (age, smoking, alcohol consumption, vegetable consumption, use of vitamins, exercise, and history of heart disease), they found that men who simply enjoyed a daily morning bowl of whole grain (but not refined) cereal had a 29% lower risk of heart failure. Isn't your heart worth protecting, especially when the prescription—a morning bowl of hearty whole grains—is so delicious? For quick, easy, heart-healthy, whole grain recipes, click The World's Healthiest Foods, and look at the "How to Enjoy" section in any of our grain profiles.

Barley and Other Whole Grains Substantially Lower Risk of Type 2 Diabetes

Barley and other whole grains are rich sources of magnesium, a mineral that acts as a co-factor for more than 300 enzymes, including enzymes involved in the body's use of glucose and insulin secretion.

The FDA permits foods that contain at least 51% whole grains by weight (and are also low in fat, saturated fat, and cholesterol) to display a health claim stating consumption is linked to lower risk of heart disease and certain cancers. Now, research suggests regular consumption of whole grains also reduces risk of type 2 diabetes.

In this 8-year trial, involving 41,186 particpants of the Black Women's Health Study, research data confirmed inverse associations between magnesium, calcium and major food sources in relation to type 2 diabetes that had already been reported in predominantly white populations.

Risk of type 2 diabetes was 31% lower in black women who frequently ate whole grains compared to those eating the least of these magnesium-rich foods. When the women's dietary intake of magnesium intake was considered by itself, a beneficial, but lesser—19%—reduction in risk of type 2 diabetes was found, indicating that whole grains offer special benefits in promoting healthy blood sugar control. Daily consumption of low-fat dairy foods was also helpful, lowering risk of type 2 diabetes by 13%. So, if you'd like to enjoy a hot bowl of barley for breakfast (an especially good idea—see immediately below), serve topped with low-fat milk.

A Better Breakfast Choice for Persons with Type 2 Diabetes

Barley may be an even better breakfast choice than oats for persons with Type 2 diabetes. In a study conducted by the Agricultural Research Service at the Diet and Human Performance Laboratory in Beltsville, MD, barley was much more effective in reducing both glucose and insulin responses than oats.

In this study, which involved 10 overweight women (mean age: 50 years, body mass index: 30), subjects ate a controlled diet for 2 days and were then given, in rotation, glucose alone and then 4 test meals in which 2/3 of the carbohydrate came first from oat flour then oatmeal, barley flour or barley flakes.

Glucose responses were reduced after test meals by both oats and barley, although more by barley (29-36% by oats and 59-65% by barley). Insulin responses after test meals were significantly reduced *only* by barley (44-56%). Interestingly, whether the oats or barley was consumed in the form of meal, flakes or flour had little effect. What seems to have been responsible for barley's significantly greater effectiveness in reducing both glucose and insulin responses is barley's soluble fiber content. The barley used in the study (a cultivar called Prowashonupana) contains more than 4 times the soluble fiber of common oats.

Cereal and Fruit Fiber Protective against Postmenopausal Breast Cancer

Results of a prospective study involving 51,823 postmenopausal women for an average of 8.3 years showed a 34% reduction in breast cancer risk for those consuming the most fruit fiber compared to those consuming the least. In addition, in the subgroup of women who had ever used hormone replacement, those consuming the most fiber, especially cereal fiber, had a 50% reduction in their risk of breast cancer compared to those consuming the least. Fruits richest in fiber include apples, dates, figs, pears and prunes. When choosing a high fiber cereal, look for whole grain cereals as they supply the most bran (a mere 1/3rd cup of bran contains about 14 grams of fiber). With its rich, nutty flavor, barley makes a great breakfast alternative to a bowl of hot oatmeal. A mere quarter-cup of barley delivers one-quarter of the RDI for fiber!

Barley Can Help Prevent Gallstones

Eating foods high in insoluble fiber, such as barley, can help women avoid gallstones, shows a study published in the *American Journal of Gastroenterology*.

Studying the overall fiber intake and types of fiber consumed over a 16 year period by almost 70,000 women in the Nurses Health Study, researchers found that those consuming the most fiber overall (both soluble and insoluble) had a 13% lower risk of developing gallstones compared to women consuming the fewest fiber-rich foods.

Those eating the most foods rich in insoluble fiber gained even more protection against gallstones: a 17% lower risk compared to women eating the least. And the protection was dose-related; a 5-gram increase in insoluble fiber intake dropped risk dropped 10%.

How do foods rich in insoluble fiber help prevent gallstones? Researchers think insoluble fiber not only speeds intestinal transit time (how quickly food moves through the intestines), but reduces the secretion of bile acids (excessive amounts contribute to gallstone formation), increases insulin sensitivity and lowers triglycerides (blood fats). Abundant in all whole grains, insoluble fiber is also found in nuts and the edible skin of fruits and vegetables including tomatoes, cucumbers, many squash, apples, berries, and pears. In addition, beans provide insoluble as well as soluble fiber.

Whole Grains and Fish Highly Protective against Childhood Asthma

According to the American Lung Association, almost 20 million Americans suffer from asthma, which is reported to be responsible for over 14 million lost school days in children, and an annual economic cost of more than $16.1 billion.

Increasing consumption of whole grains and fish could reduce the risk of childhood asthma by about 50%, suggests the International Study on Allergy and Asthma in Childhood (Tabak C, Wijga AH, *Thorax*).

The researchers, from the Dutch National Institute of Public Health and the Environment, Utrecht University, University Medical Center Groningen, used food frequency questionnaires completed by the parents of 598 Dutch children aged 8-13 years. They assessed the children's consumption of a range of foods including fish, fruits, vegetables, dairy and whole grain products. Data on asthma and wheezing were also assessed using medical tests as well as questionnaires.

While no association between asthma and intake of fruits, vegetables, and dairy products was found (a result at odds with other studies that have supported a link between antioxidant intake, particularly vitamins C and E, and asthma), the children's intake of both whole grains and fish was significantly linked to incidence of wheezing and current asthma.

In children with a low intake of fish and whole grains, the prevalence of wheezing was almost 20%, but was only 4.2% in children with a high intake of both foods. Low intake of fish and whole grains also correlated with a much higher incidence of current asthma (16.7%). compared to only a 2.8% incidence of current asthma among children with a high intake of both foods.

After adjusting results for possible confounding factors, such as the educational level of the mother, and total energy intake, high intakes of whole grains and fish were found to be associated with a 54 and 66% reduction in the probability of being asthmatic, respectively.

The probability of having asthma with bronchial hyperresponsiveness (BHR), defined as having an increased sensitivity to factors that cause narrowing of the airways, was reduced by 72 and 88% when children had a high-intake of whole grains and fish, respectively.

Lead researcher, CoraTabak commented, "The rise in the prevalence of asthma in western societies may be related to changed dietary habits." We agree. The Standard American Diet is sorely deficient in the numerous anti-inflammatory compounds found in fish and whole grains, notably, the omega-3 fats supplied by cold water fish and the magnesium and vitamin E provided by whole grains. One caution: wheat may need to be avoided as it is a common food allergen associated with asthma.

Promote Optimal Health with Barley's Fiber and Selenium

For people worried about colon cancer risk, barley packs a double punch by providing the fiber needed to minimize the amount of time cancer-causing substances spend in contact with colon cells, plus being a very good source of selenium, which has been shown to reduce the risk of colon cancer significantly.

Selenium is an essential component of several major metabolic pathways, including thyroid hormone metabolism, antioxidant defense systems, and immune function. Accumulated evidence from prospective studies, intervention trials and studies on animal models of cancer has suggested a strong inverse correlation between selenium intake and cancer incidence. Several mechanisms have been suggested to explain the cancer-preventive activities of selenium. Selenium has been shown to induce DNA repair and synthesis in damaged cells, to inhibit the proliferation of cancer cells, and to induce their *apoptosis*, the self-destruct sequence the body uses to eliminate worn out or abnormal cells.

In addition, selenium is incorporated at the active site of many proteins, including *glutathione peroxidase*, which is particularly important for cancer protection. One of the body's most powerful antioxidant enzymes, *glutathione peroxidase* is used in the liver to detoxify a wide range of potentially harmful molecules. When levels of *glutathione peroxidase* are too low, these toxic molecules are not disarmed and wreak havoc on any cells with which they come in contact, damaging their cellular DNA and promoting the development of cancer cells.

Not only does selenium play a critical role in cancer prevention as a cofactor of *glutathione peroxidase*, selenium also works with vitamin E in numerous other vital antioxidant systems throughout the body. These powerful antioxidant actions make selenium helpful for the prevention not only of cancer, but also of heart disease, and for decreasing the symptoms of asthma and arthritis.

Phenolics, powerful antioxidants that work in multiple ways to prevent disease, are one major class of phytonutrients that have been widely studied. Included in this broad category are such compounds as quercetin, curcumin, ellagic acid, catechins, and many others that appear frequently in the health news.

When Dr. Liu and his colleagues measured the relative amounts of phenolics, and whether they were present in bound or free form, in common fruits and vegetables like apples, red grapes, broccoli and spinach, they found that phenolics in the "free" form averaged 76% of the total number of phenolics in these foods. In whole grains, however, "free" phenolics accounted for less than 1% of the total, while the remaining 99% were in "bound" form.

In his presentation, Dr. Liu explained that because researchers have examined whole grains with the same process used to measure antioxidants in vegetables and fruits—looking for their content of "free" phenolics"—the amount and activity of antioxidants in whole grains has been vastly underestimated.

Despite the differences in fruits', vegetables' and whole grains' content of "free" and "bound" phenolics, the total antioxidant activity in all three types of whole foods is similar, according to Dr. Liu's research. His team measured the antioxidant activity of various foods, assigning each a rating based on a formula (micromoles of vitamin C equivalent per gram). Broccoli and spinach measured 80 and 81, respectively; apple and banana measured 98 and 65; and of the whole grains tested, corn measured 181, whole wheat 77, oats 75, and brown rice 56.

Dr. Liu's findings may help explain why studies have shown that populations eating diets high in fiber-rich whole grains consistently have lower risk for colon cancer, yet short-term clinical trials that have focused on fiber alone in lowering colon cancer risk, often to the point of giving subjects isolated fiber supplements, yield inconsistent results. The explanation is most likely that these studies have not taken into account the interactive effects of all the nutrients in whole grains—not just their fiber, but also their many phytonutrients.

As far as whole grains are concerned, Dr. Liu believes that the key to their powerful cancer-fighting potential is precisely their wholeness. A grain of whole wheat consists of three parts—its endosperm (starch), bran and germ. When wheat—or any whole grain—is refined, its bran and germ are removed. Although these two parts make up only 15-17% of the grain's weight, they contain 83% of its phenolics. Dr. Liu says his recent findings on the antioxidant content of whole grains reinforce the message that a variety of foods should be eaten good health. "Different plant foods have different phytochemicals," he said. "These substances go to different organs, tissues and cells, where they perform different functions. What your body needs to ward off disease is this synergistic effect—this teamwork—that is produced by eating a wide variety of plant foods, including whole grains."

Lignans Protect against Cancers and Heart Disease

One type of phytonutrient especially abundant in whole grains such as barley are plant lignans, which are converted by friendly flora in our intestines into mammalian lignans, including one called enterolactone that is thought to protect against breast and other hormone-dependent cancers as well as heart disease. In addition to whole grains, nuts, seeds and berries are rich sources of plant lignans, and vegetables, fruits, and beverages such as coffee, tea and wine also contain some. When blood levels of enterolactone were measured in over 800 postmenopausal women in a Danish study published in the *Journal of Nutrition*, women eating the most whole grains were found to have significantly higher blood levels of this protective lignan. Women who ate more cabbage and leafy vegetables also had higher enterolactone levels.

Fiber from Whole Grains and Fruit Protective against Breast Cancer

When researchers looked at how much fiber 35,972 participants in the UK Women's Cohort Study ate, they found a diet rich in fiber from whole grains, such as barley, and fruit offered significant protection against breast cancer for pre-menopausal women. (Cade JE, Burley VJ, et al., *International Journal of Epidemiology*).

Pre-menopausal women eating the most fiber (>30 grams daily) more than halved their risk of developing breast cancer, enjoying a 52% lower risk of breast cancer compared to women whose diets supplied the least fiber (<20 grams/day).

Fiber supplied by whole grains offered the most protection. Pre-menopausal women eating the most whole grain fiber (at least 13 g/day) had a 41% reduced risk of breast cancer, compared to those with the lowest whole grain fiber intake (4 g or less per day).

Fiber from fruit was also protective. Pre-menopausal women whose diets supplied the most fiber from fruit (at least 6 g/day) had a 29% reduced risk of breast cancer, compared to those with the lowest fruit fiber intake (2 g or less per day).

Practical Tip: As the following table shows, it's surprisingly easy to enjoy a healthy way of eating that delivers at least 13 grams of whole grain fiber and 6 grams of fiber from fruit each day.

Food	Fiber Content in Grams
Oatmeal, 1 cup	3.98
Whole wheat bread, 1 slice	2
Whole wheat spaghetti, 1 cup	6.3
Brown rice, 1 cup	3.5
Barley, 1 cup	13.6
Buckwheat, 1 cup	4.54
Rye, 1/3 cup	8.22
Corn, 1 cup	4.6
Apple, 1 medium with skin	5.0
Banana, 1 medium	4.0
Blueberries, 1 cup	3.92
Orange, 1 large	4.42
Pear, 1 large	5.02
Prunes, 1/4 cup	3.02
Strawberries, 1 cup	3.82
Raspberries, 1 cup	8.36

*Fiber content can vary between brands.

Source: esha Research, Food Processor for Windows, Version 7.8

Barley's Copper Can Benefit Arthritis Sufferers

Copper, another trace mineral supplied by barley, may also be helpful in reducing the symptoms of rheumatoid arthritis. Copper is an essential cofactor of a key oxidative enzyme called *superoxide dismutase*. *Superoxide dismutase* disarms free radicals produced within the *mitochondria* (the energy production factories within our cells). Copper is also necessary for the activity of *lysyl oxidase*, an enzyme involved in cross-linking collagen and elastin, both of which provide the ground substance and flexibility in blood vessels, bones and joints. One cup of cooked barley provides 32.0% of the daily value for copper.

Development and Repair of Body Tissue

The phosphorus provided by barley plays a role in the structure of every cell in the body. In addition to its role in forming the mineral matrix of bone, phosphorus is an essential component of numerous other life-critical compounds including *adenosine triphosphate* or ATP, the molecule that is the energy currency of the body. Phosphorus is an important component of nucleic acids, the building blocks of the genetic code. In addition, the metabolism of lipids (fats) relies on phosphorus, and phosphorus is an essential component of lipid-containing structures such as cell membranes and nervous system structures. A cup of cooked barley will give you 23.0% of the daily value for phosphorus.

Meta-analysis Explains Whole Grains' Health Protective Benefits

In many studies, eating whole grains, such as barley, has been linked to protection against atherosclerosis, ischemic stroke, diabetes, insulin resistance, obesity, and premature death. A new study and accompanying editorial, published in the American Journal of Clinical Nutrition explains the likely reasons behind these findings and recommends at least 3 servings of whole grains should be eaten daily.

Whole grains are concentrated sources of fiber. In this meta-analysis of 7 studies including more than 150,000 persons, those whose diets provided the highest dietary fiber intake had a 29% lower risk of cardiovascular disease compared to those with the lowest fiber intake.

But it's not just fiber's ability to serve as a bulking agent that is responsible for its beneficial effects as a component of whole grains. Wheat bran, for example, which constitutes 15% of most whole-grain wheat kernels but is virtually non-existent in refined wheat flour, is rich in minerals, antioxidants, lignans, and other phytonutrients:mdash;as well as in fiber.

In addition to the matrix of nutrients in their dietary fibers, the whole-grain arsenal includes a wide variety of additional nutrients and phytonutrients that reduce the risk of cardiovascular disease. Compounds in whole grains that have cholesterol-lowering effects include polyunsaturated fatty acids, oligosaccharides, plant sterols and stanols, and saponins.

Whole grains are also important dietary sources of water-soluble, fat-soluble, and insoluble antioxidants. The long list of cereal antioxidants includes vitamin E, tocotrieonols, selenium, phenolic acids, and phytic acid. These multifunctional antioxidants come in immediate-release to slow-release forms and thus are available throughout the gastrointestinal tract over a long period after being consumed.

The high antioxidant capacity of wheat bran, for example, is 20-fold that of refined wheat flour (endosperm). Although the role of antioxidant supplements in protecting against cardiovascular disease has been questioned, prospective population studies consistently suggest that when consumed in whole foods, antioxidants are associated with significant protection against cardiovascular disease. Because free radical damage to cholesterol appears to contribute significantly to the development of atherosclerosis, the broad range of antioxidant activities from the phytonutrients abundant in whole-grains is thought to play a strong role in their cardio-protective effects.

Like soybeans, whole grains are valuable sources of phytoestrogens, plant compounds that may affect blood cholesterol levels, blood vessel elasticity, bone metabolism, and many other cellular metabolic processes.

Whole grains are rich sources of lignans that are converted by the human gut to enterolactone and enterodiole. In studies of Finnish men, blood levels of enterolactone have been found to have an inverse relation not just to cardiovascular-related death, but to all causes of death, which suggests that the plant lignans in whole grains may play an important role in their protective effects.

Lower insulin levels may also contribute to the protective effects of whole grains. In many persons, the risks of atherosclerotic cardiovascular disease, diabetes, and obesity are linked to insulin resistance. Higher intakes of whole grains are associated with increased sensitivity to insulin in population studies and clinical trials. Why? Because whole grains improve insulin sensitivity by lowering the glycemic index of the diet while increasing its content of fiber, magnesium, and vitamin E.

The whole kernel of truth: as part of your healthy way of eating, whole grains can significantly lower your risk of cardiovascular disease, obesity and type 2 diabetes. Enjoy at least 3 servings a day. No idea how to cook whole grains? Just look at the "How to Enjoy" section in our profiles of the whole grains, or for quick, easy, delicious recipes, click on this link to our Recipe Assistant and select whatever whole grain you would like to prepare.

Description

Barley is a wonderfully versatile cereal grain with a rich nutlike flavor and an appealing chewy, pasta-like consistency, the result of its gluten content. Its appearance resembles wheat berries, although it is slightly lighter in color. Sprouted barley is naturally high in *maltose*, a sugar that serves as the basis for both malt syrup sweetener and when fermented, as an ingredient in beer and other alcoholic beverages.

Barley can be found in the market in various different forms:

- Hulled barley: Like the name suggests, the outermost hull of the grain is all that gets removed in this form of barley. While this makes for a chewier grain that requires more soaking and cooking, it also makes for a more nutritious food. Hulled barley is also sometimes called "dehulled barley," and it is the one form of barley what would be considered whole grain.
- Pearl barley: Various degrees of polishing, or "pearling" take place in the production of pearl barley. In addition to a polishing off of the outermost hull, the grain's bran layer, and even parts of its inner endosperm layer, may be removed during the pearling process. In general, as you move from regular to medium to fine to baby pearl barley, you find increasing loss of nutrients. Pearl barley is much less chewy and quicker cooking than hulled barley, but it is also much lower in nutrients, and would not be considered whole grain.
- Pot/scotch barley: In terms of processing, this form of barley falls in between hulled and pearl barley. It's been polished to remove its outer hull, but the polishing process is not continued for much longer, so that a large amount of the remaining grain is left intact. While pot barley would not technically be considered whole grain, and would lack some of

the benefits of hulled barley, it is still a very reasonable nutritional choice and more nutrient dense than pearl barley. In many countries, pot barley is popular in soups - thus the origin of its name.
- Barley flakes: Flattened and sliced, barley flakes are similar in shape to rolled oats. Barley flakes can be made from hulled, hulless, or pearl barley, and can be significantly different in nutrient content for this reason.
- Barley grits: Barley that has been toasted and cracked, barley grits are similar in appearance to bulgar. Barley grits can be made from hulled, hulless, or pearl barley, and can be significantly different in nutrient content for this reason.

The Latin name for barley is *Hordeum vulgare*.

History

Barley originated in Ethiopia and Southeast Asia, where it has been cultivated for more than 10,000 years. Barley was used by ancient civilizations as a food for humans and animals, as well as to make alcoholic beverages; the first known recipe for barley wine dates back to 2800 BC in Babylonia. In addition, since ancient times, barley water has been used for various medicinal purposes.

Barley played an important role in ancient Greek culture as a staple bread-making grain as well as an important food for athletes, who attributed much of their strength to their barley-containing training diets. Roman athletes continued this tradition of honoring barley for the strength that it gave them. Gladiators were known as *hordearii*, which means "eaters of barley." Barley was also honored in ancient China as a symbol of male virility since the heads of barley are heavy and contain numerous seeds.

Since wheat was very expensive and not widely available in the Middle Ages, many Europeans at that time made bread from a combination of barley and rye. In the 16th century, the Spanish introduced barley to South America, while the English and Dutch settlers of the 17th century brought it with them to the United States.

Today, the largest commercial producers of barley are Canada, the United States, the Russian Federation, Germany, France and Spain.

How to Select and Store

Barley is generally available in its pearled, hulled and flaked form. It is available prepackaged as well as in bulk containers. Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the barley are covered and that the store has a good product turnover so as to ensure its maximal freshness. Whether purchasing barley in bulk or in a packaged container, make sure that there is no evidence of moisture.

Store barley in a tightly covered glass container in a cool, dry place. Barley can also be stored in the refrigerator during periods of warmer weather.

How to Enjoy

A Few Quick Serving Ideas:

Mix barley flour with wheat flour to make breads and muffins that have a uniquely sweet and earthy taste.

Use cracked barley or barley flakes to make hot cereal.

Toss chilled cooked hulled barley with chopped vegetables and dressing to make a tasty cold salad.

Add barley to your favorite stews and soups to give them extra heartiness and flavor.

Combine cooked barley and healthy sautéed mushrooms for a pilaf with an Eastern European twist.

For some of our favorite recipes, click Recipes.

Safety

Barley and the Gluten Grains

Barley is a member of a non-scientifically established grain group traditionally called the "gluten grains." The idea of grouping certain grains together under the label "gluten grains" has come into question in recent years as technology has given food scientists a way to look more closely at the composition of grains. Some healthcare practitioners continue to group wheat, oats, barley and rye together under the heading of "gluten grains" and to ask for elimination of the entire group on a wheat-free diet. Other practitioners now treat wheat separately from these other grains, including barley, based on recent research. Wheat is unquestionably a more common source of food reactions than any of the other "gluten grains," including barley. Although you may initially want to eliminate barley from your meal planning if you are implementing a wheat-free diet, you will want to experiment at some point with re-introduction of this food. You may be able to take advantage of its diverse nutritional benefits without experiencing an adverse reaction. Individuals with wheat-related conditions like celiac sprue or gluten-sensitive enteropathies should consult with their healthcare practitioner before experimenting with any of the "gluten grains," including barley.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Barley, hulled, dry
0.33 cup
61.33 grams

Calories: 217
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
molybdenum	26.99 mcg	60	5.0	very good
manganese	1.19 mg	60	4.9	very good
fiber	10.61 g	42	3.5	very good
selenium	23.12 mcg	42	3.5	very good
copper	0.31 mg	34	2.9	good
vitamin B1	0.40 mg	33	2.8	good
chromium	8.16 mcg	23	1.9	good
phosphorus	161.92 mg	23	1.9	good
magnesium	81.57 mg	20	1.7	good
vitamin B3	2.82 mg	18	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Brown rice

In some parts of the world, the word "to eat" literally means "to eat rice." All varieties of rice are available throughout the year, supplying as much as half of the daily calories for half of the world's population.

The process that produces brown rice removes only the outermost layer, the hull, of the rice kernel and is the least damaging to its nutritional value. The complete milling and polishing that converts brown rice into white rice destroys 67% of the vitamin B3, 80% of the vitamin B1, 90% of the vitamin B6, half of the manganese, half of the phosphorus, 60% of the iron, and all of the dietary fiber and essential fatty acids. Fully milled and polished white rice is required to be "enriched" with vitamins B1, B3 and iron.

Brown Rice, long grain, cooked
1.00 cup
(195.00 grams)

Calories: 216
GI: low

Nutrient	DRI/DV
manganese	88%
selenium	35%
phosphorus	23%
magnesium	21%
copper	21%
vitamin B3	19%

Health Benefits

Why Brown--But Not White--Rice is One of the World's Healthiest Foods

The difference between brown rice and white rice is not just color! A whole grain of rice has several layers. Only the outermost layer, the *hull*, is removed to produce what we call brown rice. This process is the least damaging to the nutritional value of the rice and avoids the unnecessary loss of nutrients that occurs with further processing. If brown rice is further milled to remove the bran and most of the germ layer, the result is a whiter rice, but also a rice that has lost many more nutrients. At this point, however, the rice is still unpolished, and it takes polishing to produce the white rice we are used to seeing. Polishing removes the *aleurone layer* of the grain--a layer filled with health-supportive, essential fats. Because these fats, once exposed to air by the refining process, are highly susceptible to oxidation, this layer is removed to extend the shelf life of the product. The resulting white rice is simply a refined starch that is largely bereft of its original nutrients.

Our food ranking system qualified brown rice as an excellent source of manganese, and a good source of selenium, phosphorus, copper, magnesium, and niacin (vitamin B3). The complete milling and polishing that converts brown rice into white rice destroys 67% of the vitamin B3, 80% of the vitamin B1, 90% of the vitamin B6, half of the manganese, half of the phosphorus, 60% of the iron, and all of the dietary fiber and essential fatty acids. By law in the United States, fully milled and polished white rice must be "enriched" with vitamins B1, B3, and iron. But the form of these nutrients when added back into the processed rice is not the same as in the original unprocessed version, and at least 11 lost nutrients are not replaced in any form even with rice "enrichment."

Here are some of the ways in which the nutrients supplied by brown rice can make an important difference in your health:

Manganese—Energy Production Plus Antioxidant Protection

Manganese helps produce energy from protein and carbohydrates and is involved in the synthesis of fatty acids, which are important for a healthy nervous system, and in the production of cholesterol, which is used by the body to produce sex hormones. Manganese is also a critical component of a very important antioxidant enzyme called *superoxide dismutase*. *Superoxide dismutase* (SOD) is found inside the body's *mitochondria* (the oxygen-based energy factories inside most of our cells) where it provides protection against damage from the free radicals produced during energy production.

Women Who Eat Whole Grains Weigh Less

A study published in the *American Journal of Clinical Nutrition* underscores the importance of choosing whole grains such as brown rice rather than refined grain, i.e., white rice, to maintain a healthy body weight. In this Harvard Medical School / Brigham and Women's Hospital study, which collected data on over 74,000 female nurses aged 38-63 years over a 12 year period, weight gain was inversely associated with the intake of high-fiber, whole-grain foods but positively related to the intake of refined-grain foods. Not only did women who consumed more whole grains consistently weigh less than those who ate less of these fiber-rich foods, but those consuming the most dietary fiber from whole grains were 49% less likely to gain weight compared to those eating foods made from refined grains.

Brown Rice is Rich in Fiber and Selenium

For people worried about colon cancer risk, brown rice packs a double punch by being a concentrated source of the fiber needed to minimize the amount of time cancer-causing substances spend in contact with colon cells, and being a good source of selenium, a trace mineral that has been shown to substantially reduce the risk of colon cancer.

Selenium is an essential component of several major metabolic pathways, including thyroid hormone metabolism, antioxidant defense systems, and immune function. Accumulated evidence from prospective studies, intervention trials and studies on animal models of cancer has suggested a strong inverse correlation between selenium intake and cancer incidence. Several mechanisms have been suggested to explain the cancer-preventive activities of selenium. Selenium has been shown to induce DNA repair and synthesis in damaged cells, to inhibit the proliferation of cancer cells, and to induce their *apoptosis*, the self-destruct sequence the body uses to eliminate worn out or abnormal cells.

In addition, selenium is incorporated at the active site of many proteins, including *glutathione peroxidase*, which is particularly important for cancer protection. One of the body's most powerful antioxidant enzymes, *glutathione peroxidase* is used in the liver to detoxify a wide range of potentially harmful molecules. When levels of *glutathione peroxidase* are too low, these toxic molecules are not disarmed and wreak havoc on any cells with which they come in contact, damaging their cellular DNA and promoting the development of cancer cells.

Not only does selenium play a critical role in cancer prevention as a cofactor of *glutathione peroxidase*, selenium also works with vitamin E in numerous other vital antioxidant systems throughout the body. These powerful antioxidant actions make selenium helpful in the prevention not only of cancer, but also of heart disease, and for decreasing the symptoms of asthma and the pain and inflammation of rheumatoid arthritis.

Lower Cholesterol with Whole Brown Rice

Here's yet another reason to rely on whole foods, such as brown rice, for your healthy way of eating. The oil in whole brown rice lowers cholesterol.

When Marlene Most and colleagues from Louisiana State University evaluated the effects of rice bran and rice bran oil on cholesterol levels in volunteers with moderately elevated cholesterol levels, they found that rice bran oil lowered their LDL (bad) cholesterol.

The study, published in the *American Journal of Clinical Nutrition*, was divided into two parts. First, 26 subjects ate a diet including 13-22g of dietary fiber each day for three weeks, after which 13 switched to a diet that added defatted rice bran to double their fiber intake for five weeks. In the second part of the study, a randomized crossover trial, 14 subjects ate a diet with rice bran oil for 10 weeks.

While the diet including only defatted rice bran did not lower cholesterol, the one containing rice bran oil lowered LDL cholesterol by 7%. Since all the diets contained similar fatty acids, the researchers concluded that the reduction in cholesterol seen in those receiving rice bran oil must have been due to other constituents such as the unsaponifiable compounds found in rice bran oil. The scientists suggest that the unsaponifiables present in rice bran oil could become important functional foods for cardiovascular health. But why extract just *one* beneficial compound from brown rice when you can reap *all* the cardioprotective benefits supplied by the matrix of nutrients naturally present in this delicious whole food? In addition to unsaponifiables, this whole grain also supplies hefty doses of heart-healthy fiber, magnesium, and B vitamins.

Significant Cardiovascular Benefits for Postmenopausal Women

Eating a serving of whole grains, such as brown rice, at least 6 times each week is an especially good idea for postmenopausal women with high cholesterol, high blood pressure or other signs of cardiovascular disease (CVD).

A 3-year prospective study of over 200 postmenopausal women with CVD, published in the *American Heart Journal*, shows that those eating at least 6 servings of whole grains each week experienced both:

- Slowed progression of atherosclerosis, the build-up of plaque that narrows the vessels through which blood flows, and
- Less progression in stenosis, the narrowing of the diameter of arterial passageways.

The women's intake of fiber from fruits, vegetables and refined grains was *not* associated with a lessening in CVD progression.

Phytonutrients with Health-Promoting Activity Equal to or Even Higher than that of Vegetables and Fruits

Research reported at the American Institute for Cancer Research (AICR) International Conference on Food, Nutrition and Cancer, by Rui Hai Liu, M.D., Ph.D., and his colleagues at Cornell University shows that whole grains, such as rice, contain many powerful phytonutrients whose activity has gone unrecognized because research methods have overlooked them.

Despite the fact that for years researchers have been measuring the antioxidant power of a wide array of phytonutrients, they have typically measured only the "free" forms of these substances, which dissolve quickly and are immediately absorbed into the bloodstream. They have not looked at the "bound" forms, which are attached to the walls of plant cells and must be released by intestinal bacteria during digestion before they can be absorbed.

Phenolics, powerful antioxidants that work in multiple ways to prevent disease, are one major class of phytonutrients that have been widely studied. Included in this broad category are such compounds as quercetin, curcumin, ellagic acid, catechins, and many others that appear frequently in the health news.

When Dr. Liu and his colleagues measured the relative amounts of phenolics, and whether they were present in bound or free form, in common fruits and vegetables like apples, red grapes, broccoli and spinach, they found that phenolics in the "free" form averaged 76% of the total number of phenolics in these foods. In whole grains, however, "free" phenolics accounted for less than 1% of the total, while the remaining 99% were in "bound" form.

In his presentation, Dr. Liu explained that because researchers have examined whole grains with the same process used to measure antioxidants in vegetables and fruits—looking for their content of "free" phenolics"—the amount and activity of antioxidants in whole grains has been vastly underestimated.

Despite the differences in fruits', vegetables' and whole grains' content of "free" and "bound" phenolics, the total antioxidant activity in all three types of whole foods is similar, according to Dr. Liu's research. His team measured the antioxidant activity of various foods, assigning each a rating based on a formula (micromoles of vitamin C equivalent per gram). Broccoli and spinach measured 80 and 81, respectively; apple and banana measured 98 and 65; and of the whole grains tested, corn measured 181, whole wheat 77, oats 75, and brown rice 56.

Dr. Liu's findings may help explain why studies have shown that populations eating diets high in fiber-rich whole grains consistently have lower risk for colon cancer, yet short-term clinical trials that have focused on fiber alone in lowering colon cancer risk, often to the point of giving subjects isolated fiber supplements, yield inconsistent results. The explanation is most likely that these studies have not taken into account the interactive effects of all the nutrients in whole grains—not just their fiber, but also their many phytonutrients. As far as whole grains are concerned, Dr. Liu believes that the key to their powerful cancer-fighting potential is precisely their wholeness. A grain of whole wheat consists of three parts—its endosperm (starch), bran and germ. When wheat—or any whole grain—is refined, its bran and germ are removed. Although these two parts make up only 15-17% of the grain's weight, they contain 83% of its phenolics. Dr. Liu says his recent findings on the antioxidant content of whole grains reinforce the message that a variety of foods should be eaten good health. "Different plant foods have different phytochemicals,"he said. "These substances go to different organs, tissues and cells, where they perform different functions. What your body needs to ward off disease is this synergistic effect—this teamwork—that is produced by eating a wide variety of plant foods, including whole grains."

Lignans Protect against Heart Disease

One type of phytonutrient especially abundant in whole grains including brown rice are plant lignans, which are converted by friendly flora in our intestines into mammalian lignans, including one called enterolactone that is thought to protect against breast and other hormone-dependent cancers as well as heart disease. In addition to whole grains, nuts, seeds and berries are rich sources of plant lignans, and vegetables, fruits, and beverages such as coffee, tea and wine also contain some. When blood levels of enterolactone were measured in over 850 postmenopausal women in a Danish study published in the *Journal of*

Nutrition, women eating the most whole grains were found to have significantly higher blood levels of this protective lignan. Women who ate more cabbage and leafy vegetables also had higher enterolactone levels.

Reduce Your Risk of Metabolic Syndrome

First we were told, "Don't eat fat, and you'll stay trim." After following this advice only to see obesity expand to never before seen proportions, we're told by the food gurus, "Eating fat is fine. Shun carbohydrates to stay slim."

In our opinion, neither piece of dietary advice is complete, accurate or likely to help us stay slim or healthy. Just as different kinds of fats have different effects in our bodies (e.g., saturated and trans fats are linked to increased risk for cardiovascular disease while omega-3 fats decrease cardiovascular disease risk), some carbohydrates, such as whole grains, are healthful while others, such as refined grains and the foods made from them, are not.

The latest research is clearly supporting this vital distinction. Refined grains and the foods made from them (e.g., white breads, cookies, pastries, pasta and rice) are now being linked not only to weight gain but to increased risk of insulin resistance (the precursor of type 2 diabetes) and the metabolic syndrome (a strong predictor of both type 2 diabetes and cardiovascular disease), while eating more wholegrain foods is being shown to protect against all these ills. Common features of the metabolic syndrome include visceral obesity (the "apple shaped" body), low levels of protective HDL cholesterol, high triglycerides, and high blood pressure.

In one of the most recent studies, which appeared in *Diabetes Care*, researchers who analyzed data on over 2,800 participants in the Framingham Offspring Study, found that the prevalence of both insulin resistance and the metabolic syndrome was significantly lower among those eating the most cereal fiber from whole grains compared to those eating the least.

Prevalence of the metabolic syndrome was 38% lower among those with the highest intake of fiber from whole grains. Conversely, study subjects whose diets had the highest glycemic index and glycemic load, both of which are typically low in whole foods and high in processed refined foods, were 141% more likely to have the metabolic syndrome compared to those whose diets had the lowest glycemic index and glycemic load. In other words, compared to those whose diets were primarily composed of whole high fiber foods: whole grains, legumes, vegetables and fruits.

The researchers concluded, "Given that both a high cereal fiber content and lower glycemic index are attributes of wholegrain foods, recommendation to increase wholegrain intake may reduce the risk of developing the metabolic syndrome." Our perspective at the World's Healthiest Foods is that a way of eating that relies on the healthiest foods from all the food groups—the whole foods that contain the healthiest fats, carbohydrates and proteins—is the most effective, intelligent, and most enjoyable way to not only lower your risk of developing the metabolic syndrome, but to stay slim, vital and attractive throughout a long and healthy life.

Brown Rice and Other Whole Grains Substantially Lower Type 2 Diabetes Risk

Brown rice and other whole grains are a rich source of magnesium, a mineral that acts as a co-factor for more than 300 enzymes, including enzymes involved in the body's use of glucose and insulin secretion.

The FDA permits foods that contain at least 51% whole grains by weight (and are also low in fat, saturated fat, and cholesterol) to display a health claim stating consumption is linked to lower risk of heart disease and certain cancers. Now, research suggests regular consumption of whole grains also reduces risk of type 2 diabetes. (van Dam RM, Hu FB, *Diabetes Care*).

In this 8-year trial, involving 41,186 particpants of the Black Women's Health Study, research data confirmed inverse associations between magnesium, calcium and major food sources in relation to type 2 diabetes that had already been reported in predominantly white populations.

Risk of type 2 diabetes was 31% lower in black women who frequently ate whole grains compared to those eating the least of these magnesium-rich foods. When the women's dietary intake of magnesium intake was considered by itself, a beneficial, but lesser—19%— reduction in risk of type 2 diabetes was found, indicating that whole grains offer special benefits in promoting healthy blood sugar control. Daily consumption of low-fat dairy foods was also helpful, lowering risk of type 2 diabetes by 13%. Rice pudding—quickly made by simply adding low-fat milk, cinnamon, raisins, a little honey and 1/4 teaspoon of finely grated orange peel to a cup of cooked rice, then cooking over medium heat for 5 minutes—is a delicious way to enjoy both rice and dairy.

Tune Down and Bone Up on Brown Rice

Magnesium, another nutrient for which brown rice is a good source, has been shown in studies to be helpful for reducing the severity of asthma, lowering high blood pressure, reducing the frequency of migraine headaches, and reducing the risk of heart attack and stroke. How does magnesium accomplish all this? Magnesium helps regulate nerve and muscle tone by balancing the action of calcium. In many nerve cells, magnesium serves as Nature's own calcium channel blocker, preventing calcium from rushing into the nerve cell and activating the nerve. By blocking calcium's entry, magnesium keeps our nerves (and the blood vessels and muscles they ennervate) relaxed. If our diet provides us with too little magnesium, however, calcium can gain free entry, and nerve cells can become overactivated, sending too many messages and causing excessive contraction. Insufficient magnesium can thus contribute to high blood pressure, muscle spasms (including spasms of the heart muscle or the spasms of the airways symptomatic of asthma), and migraine headaches, as well as muscle cramps, tension, soreness and fatigue.

But that's far from all magnesium does for you. Magnesium, as well as calcium, is necessary for healthy bones. About two-thirds of the magnesium in the human body is found in our bones. Some helps give bones their physical structure, while the rest is found on the surface of the bone where it is stored for the body to draw upon as needed. Brown rice can help you keep those storage sites replenished and ready to meet your body's needs.

In addition to the niacin it supplies, brown rice may also help raise blood levels of nitric oxide, a small molecule known to improve blood vessel dilation and to inhibit oxidative (free radical) damage of cholesterol and the adhesion of white cells to the vascular wall (two important steps in the development of atherosclerotic plaques). A study published in the *British Journal of Nutrition* suggests that diets high in rice protein can help protect against atherosclerosis by increasing blood levels of nitric oxide.

In this study, when researchers gave mice bred to be apoliprotein-E deficient a purified diet containing either casein, the principal protein in dairy products, rice protein or soy protein, the mice given casein developed the largest atherosclerotic lesions. (In humans as well as animals, apolipoprotein E plays an important role in cholesterol transport, so a deficiency of this protein increases risk for the development of atherosclerosis.) Mice given rice or soy protein fared much better. In trying to understand why, the researchers evaluated blood levels of nitric oxide. Mice fed either rice or soy protein diets were found to have increased blood levels of L-arginine (the amino acid that the body uses to produce nitric oxide) and nitric oxide metabolites when compared to those given casein-based feed. However, the L-arginine content of the rice and soy diets was not high enough to explain the amount of protective benefit they conferred, so the researchers concluded that these foods must also contain other cardioprotective compounds.

A Good Source of Fiber

The health benefits of brown rice continue with its fiber, which has been shown to reduce high cholesterol levels, one more way brown rice helps prevent atherosclerosis. Fiber also helps out by keeping blood sugar levels under control, so brown rice is an excellent grain choice for people with diabetes. As we mentioned above, the fiber in brown rice can also help to protect you against colon cancer since fiber binds to cancer-causing chemicals, keeping them away from the cells lining the colon, plus it can help normalize bowel function, reducing constipation.

Fiber from Whole Grains and Fruit Protective against Breast Cancer

When researchers looked at how much fiber 35,972 participants in the UK Women's Cohort Study ate, they found a diet rich in fiber from whole grains, such as brown rice, and fruit offered significant protection against breast cancer for pre-menopausal women. (Cade JE, Burley VJ, et al., *International Journal of Epidemiology*).

Pre-menopausal women eating the most fiber (>30 grams daily) more than halved their risk of developing breast cancer, enjoying a 52% lower risk of breast cancer compared to women whose diets supplied the least fiber (<20 grams/day).

Fiber supplied by whole grains offered the most protection. Pre-menopausal women eating the most whole grain fiber (at least 13 g/day) had a 41% reduced risk of breast cancer, compared to those with the lowest whole grain fiber intake (4 g or less per day).

Fiber from fruit was also protective. Pre-menopausal women whose diets supplied the most fiber from fruit (at least 6 g/day) had a 29% reduced risk of breast cancer, compared to those with the lowest fruit fiber intake (2 g or less per day).

Practical Tip: As the following table shows, it's surprisingly easy to enjoy a healthy way of eating that delivers at least 13 grams of whole grain fiber and 6 grams of fiber from fruit each day.

Food	Fiber Content in Grams

Oatmeal, 1 cup	3.98
Whole wheat bread, 1 slice	2
Whole wheat spaghetti, 1 cup	6.3
Brown rice, 1 cup	3.5
Barley, 1 cup	13.6
Buckwheat, 1 cup	4.54
Rye, 1/3 cup	8.22
Corn, 1 cup	4.6
Apple, 1 medium with skin	5.0
Banana, 1 medium	4.0
Blueberries, 1 cup	3.92
Orange, 1 large	4.42
Pear, 1 large	5.02
Prunes, 1/4 cup	3.02
Strawberries, 1 cup	3.82
Raspberries, 1 cup	8.36

*Fiber content can vary between brands. Source: esha Research, Food Processor for Windows, Version 7.8

Help Prevent Gallstones

Eating foods high in insoluble fiber, such as brown rice, can help women avoid gallstones, shows a study published in the *American Journal of Gastroenterology*.

Studying the overall fiber intake and types of fiber consumed over a 16 year period by over 69,000 women in the Nurses Health Study, researchers found that those consuming the most fiber overall (both soluble and insoluble) had a 13% lower risk of developing gallstones compared to women consuming the fewest fiber-rich foods.

Those eating the most foods rich in insoluble fiber gained even more protection against gallstones: a 17% lower risk compared to women eating the least. And the protection was dose-related; a 5-gram increase in insoluble fiber intake dropped risk dropped 10%.

How do foods rich in insoluble fiber help prevent gallstones? Researchers think insoluble fiber not only speeds intestinal transit time (how quickly food moves through the intestines), but reduces the secretion of bile acids (excessive amounts contribute to gallstone formation), increases insulin sensitivity and lowers triglycerides (blood fats). Abundant not just in brown rice but all whole grains, insoluble fiber is also found in nuts and the edible skin of fruits and vegetables including tomatoes, cucumbers, many squash, apples, berries, and pears. In addition, beans provide insoluble as well as soluble fiber.

Whole Grains and Fish Highly Protective against Childhood Asthma

According to the American Lung Association, almost 20 million Americans suffer from asthma, which is reported to be responsible for over 14 million lost school days in children, and an annual economic cost of more than $16.1 billion.

Increasing consumption of whole grains and fish could reduce the risk of childhood asthma by about 50%, suggests the International Study on Allergy and Asthma in Childhood (Tabak C, Wijga AH, *Thorax*).

The researchers, from the Dutch National Institute of Public Health and the Environment, Utrecht University, University Medical Center Groningen, used food frequency questionnaires completed by the parents of 598 Dutch children aged 8-13 years. They assessed the children's consumption of a range of foods including fish, fruits, vegetables, dairy and whole grain products. Data on asthma and wheezing were also assessed using medical tests as well as questionnaires.

While no association between asthma and intake of fruits, vegetables, and dairy products was found (a result at odds with other studies that have supported a link between antioxidant intake, particularly vitamins C and E, and asthma), the children's intake of both whole grains and fish was significantly linked to incidence of wheezing and current asthma.

In children with a low intake of fish and whole grains, the prevalence of wheezing was almost 20%, but was only 4.2% in children with a high intake of both foods. Low intake of fish and whole grains also correlated with a much higher incidence of current asthma (16.7%). compared to only a 2.8% incidence of current asthma among children with a high intake of both foods.

After adjusting results for possible confounding factors, such as the educational level of the mother, and total energy intake, high intakes of whole grains and fish were found to be associated with a 54 and 66% reduction in the probability of being asthmatic, respectively.

The probability of having asthma with bronchial hyperresponsiveness (BHR), defined as having an increased sensitivity to factors that cause narrowing of the airways, was reduced by 72 and 88% when children had a high-intake of whole grains and fish, respectively. Lead researcher, CoraTabak commented, "The rise in the prevalence of asthma in western societies may be related to changed dietary habits." We agree. The Standard American Diet is sorely deficient in the numerous anti-inflammatory compounds found in fish and whole grains, notably, the omega-3 fats supplied by cold water fish and the magnesium and vitamin E provided by whole grains. One caution: wheat may need to be avoided as it is a common food allergen associated with asthma.

Meta-analysis Explains Whole Grains' Health Benefits

In many studies, eating whole grains, such as brown rice, has been linked to protection against atherosclerosis, ischemic stroke, diabetes, insulin resistance, obesity, and premature death. A new study and accompanying editorial, published in the American Journal of Clinical Nutrition explains the likely reasons behind these findings and recommends at least 3 servings of whole grains should be eaten daily.

Whole grains are concentrated sources of fiber. In this meta-analysis of 7 studies including more than 150,000 persons, those whose diets provided the highest dietary fiber intake had a 29% lower risk of cardiovascular disease compared to those with the lowest fiber intake.

But it's not just fiber's ability to serve as a bulking agent that is responsible for its beneficial effects as a component of whole grains. Wheat bran, for example, which constitutes 15% of most whole-grain wheat kernels but is virtually non-existent in refined wheat flour, is rich in minerals, antioxidants, lignans, and other phytonutrients—as well as in fiber.

In addition to the matrix of nutrients in their dietary fibers, the whole-grain arsenal includes a wide variety of additional nutrients and phytochemicals that reduce the risk of cardiovascular disease. Compounds in whole grains that have cholesterol-lowering effects include polyunsaturated fatty acids, oligosaccharides, plant sterols and stanols, and saponins.

Whole grains are also important dietary sources of water-soluble, fat-soluble, and insoluble antioxidants. The long list of cereal antioxidants includes vitamin E, tocotrieonols, selenium, phenolic acids, and phytic acid. These multifunctional antioxidants come in immediate-release to slow-release forms and thus are available throughout the gastrointestinal tract over a long period after being consumed.

The high antioxidant capacity of wheat bran, for example, is 20-fold that of refined wheat flour (endosperm). Although the role of antioxidant supplements in protecting against cardiovascular disease has been questioned, prospective population studies consistently suggest that when consumed in whole foods, antioxidants are associated with significant protection against cardiovascular disease. Because free radical damage to cholesterol appears to contribute significantly to the development of atherosclerosis, the broad range of antioxidant activities from the phytonutrients abundant in whole grains is thought to play a strong role in their cardio-protective effects.

Like soybeans, whole grains are good sources of phytoestrogens, plant compounds that may affect blood cholesterol levels, blood vessel elasticity, bone metabolism, and many other cellular metabolic processes.

Whole grains are rich sources of lignans that are converted by the human gut to enterolactone and enterodiole. In studies of Finnish men, blood levels of enterolactone have been found to have an inverse relation not just to cardiovascular-related death, but to all causes of death, which suggests that the plant lignans in whole grains may play an important role in their protective effects.

Lower insulin levels may also contribute to the protective effects of whole grains. In many persons, the risks of atherosclerotic cardiovascular disease, diabetes, and obesity are linked to insulin resistance. Higher intakes of whole grains are associated with increased sensitivity to insulin in population studies and clinical trials. Why? Because whole grains improve insulin sensitivity by lowering the glycemic index of the diet while increasing its content of fiber, magnesium, and vitamin E.

The whole kernel of truth: as part of your healthy way of eating, whole grains can significantly lower your risk of cardiovascular disease, obesity and type 2 diabetes. Enjoy at least 3 servings a day. No idea how to cook whole grains? Just look at the "How to Enjoy" section in our profiles of the whole grains, or for quick, easy, delicious recipes, click on this link to our Recipe Assistant and select brown rice or whichever whole grain you would like to prepare.

For all the health benefits brown rice can provide, don't forget to make this delicious, nutty-flavored grain a frequent addition to your meals.

Description

Rice is one of the most important foods in the world, supplying as much as half of the daily calories for half of the world's population. No wonder that in Asian countries, such as Thailand, rice is so highly valued that the translation of the word "to eat" literally means "to eat rice."

Asked to name the types of rice they are familiar with, people may be able to recall one or two. Yet, in actuality there is an abundance of different types of rice—over 8,000 varieties. Oftentimes, rice is categorized by its size as being either short grain, medium grain or long grain. Short grain, which has the highest starch content, makes the stickiest rice, while long grain is lighter and tends to remain separate when cooked. The qualities of medium grain fall between the other two types.

The scientific name for rice is *Oryza sativa*.

Another way that rice is classified is according to the degree of milling that it undergoes. This is what makes a brown rice different than white rice. Brown rice, often referred to as whole rice or cargo rice, is the whole grain with only its inedible outer hull removed. Brown rice still retains its nutrient-rich bran and germ. White rice, on the other hand, is both milled and polished, which removes the bran and germ along with all the nutrients that reside within these important layers.

Some of the most popular varieties of rice in this country include:

- Arborio: A round grain, starchy white rice, traditionally used to make the Italian dish *risotto*.
- Basmati: An aromatic rice that has a nutlike fragrance, delicate flavor and light texture.
- Sweet rice: Almost translucent when it is cooked, this very sticky rice is traditionally used to make sushi and mochi.
- Jasmine: A soft-textured long grain aromatic rice that is available in both brown and white varieties.
- Bhutanese red rice: Grown in the Himalayas, this red colored rice has a nutty, earthy taste.
- Forbidden rice: A black colored rice that turns purple upon cooking and has a sweet taste and sticky texture.

History

Everyone knows that rice is an ancient food, but only recently have we discovered just how ancient it is. Rice was believed to have been first cultivated in China around 6,000 years ago, but recent archaeological discoveries have found primitive rice seeds and ancient farm tools dating back about 9,000 years.

For the majority of its long history, rice was a staple only in Asia. Not until Arab travelers introduced rice into ancient Greece, and Alexander the Great brought it to India, did rice find its way to other corners of the world. Subsequently, the Moors brought rice to Spain in the 8th century during their conquests, while the Crusaders were responsible for bringing rice to France. Rice was introduced into South America in the 17th century by the Spanish during their colonization of this continent.

The majority of the world's rice is grown in Asia, where it plays an incredibly important role in their food culture. Thailand, Vietnam and China are the three largest exporters of rice.

How to Select and Store

Rice is available prepackaged as well as in bulk containers. If purchasing brown rice in a packaged container, check to see if there is a "use-by" date on the package since brown rice, owing to its natural oils, has the potential to become rancid if kept too long.

Research recently published suggests that some *non-organic* U.S. long grain rice may have 1.4 to 5 times more arsenic than rice from Europe, India or Bangladesh. For this reason, select organically grown rice whenever possible. (More detailed information on this study can be found below in the Individual Concerns section.)

Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the rice are covered and that the store has a good product turnover so as to ensure its maximal freshness. Whether purchasing rice in bulk or in a packaged container, make sure that there is no evidence of moisture.

Since brown rice still features an oil-rich germ, it is more susceptible to becoming rancid than white rice and therefore should be stored in the refrigerator. Stored in an airtight container, brown rice will keep fresh for about six months.

While white rice varieties should also be stored in an airtight container, they can be kept in a cool, dry place rather than the refrigerator. Stored properly, they will keep fresh for about one year.

The storage of cooked rice is controversial. Most organizations recommend 4-7 days of storage in the refrigerator at most. From all of the available evidence, however, and to err on the safe side, we believe it's best to cook only the amount of rice you can consume during the day it is cooked, or at most, the following day.Several potential toxins can be produced in rice under certain conditions involving time, temperature, presence of moisture, bacterial spores, or fungi. It appears that some fungi can turn one of the amino acids (tryptophan) in rice into alpha-picolinic acid, and that this substance, when excessive, can cause hypersensitivity reactions to rice in some persons. Another mycotoxin (fungus-triggered toxin) called T-2 can also be produced in rice by the fungus Fusarium. About 300 mycotoxins are commonly found in many grains, not only rice, when these grains are allowed to become moldy. All of the research we've see on these potential toxins involves cultivation and harvesting of rice at the agricultural level rather than cooking and storage of rice at home. However, we still suggest erring on the safe side here. Be sure to keep your cooked rice in a tightly sealed container when stored in your refrigerator.

How to Enjoy

A Few Quick Serving Ideas

- Heat up cooked rice with milk or soymilk. Add in cinnamon, nutmeg, raisins and honey for a delicious rice pudding.
- Make homemade vegetable sushi rolls by wrapping brown rice and your favorite vegetables in sheets of well-moistened nori.
- Use rice leftovers for cold rice salads that are great for on-the-go lunches. Be creative and add either chicken or tofu plus your favorite vegetables, nuts, herbs and spices.
- For a simple yet delicious lunch or dinner entrée, serve beans and rice accompanied by the vegetables of your choice.
- Rice as a side dish need not be served plain - spruce it up with the toppings of your choice. Some of our favorites include nuts, sesame seeds, healthy sautéed mushrooms, and scallions.
- Place rice and chopped vegetables in a pita bread, top with your favorite dressing, and enjoy a quick and easy lunch meal.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Brown Rice, long grain, cooked
1.00 cup
195.00 grams

Calories: 216
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
manganese	1.76 mg	88	7.3	excellent
selenium	19.11 mcg	35	2.9	good

phosphorus	161.85 mg	23	1.9	good
copper	0.19 mg	21	1.8	good
magnesium	83.85 mg	21	1.7	good
vitamin B3	2.98 mg	19	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Buckwheat

Energizing and nutritious, buckwheat is available throughout the year and can be served as an alternative to rice or made into porridge.

While many people think that buckwheat is a cereal grain, it is actually a fruit seed that is related to rhubarb and sorrel making it a suitable substitute for grains for people who are sensitive to wheat or other grains that contain protein glutens. Buckwheat flowers are very fragrant and are attractive to bees that use them to produce a special, strongly flavored, dark honey.

Buckwheat, groats, cooked
1.00 cup
(168.00 grams)

Calories: 155
GI: low

Nutrient	DRI/DV
manganese	34%
copper	28%
magnesium	21%
fiber	18%
phosphorus	17%

Health Benefits

A Grain That's Good for Your Cardiovascular System

Diets that contain buckwheat have been linked to lowered risk of developing high cholesterol and high blood pressure. The Yi people of China consume a diet high in buckwheat (100 grams per day, about 3.5 ounces). When researchers tested blood lipids of 805 Yi Chinese, they found that buckwheat intake was associated with lower total serum cholesterol, lower low-density lipoprotein cholesterol (LDL, the form linked to cardiovascular disease), and a high ratio of HDL (health-promoting cholesterol) to total cholesterol.

Buckwheat's beneficial effects are due in part to its rich supply of flavonoids, particularly *rutin*. Flavonoids are phytonutrients that protect against disease by extending the action of vitamin C and acting as antioxidants. Buckwheat's lipid-lowering activity is largely due to rutin and other flavonoid compounds. These compounds help maintain blood flow, keep platelets from clotting excessively (platelets are compounds in blood that, when triggered, clump together, thus preventing excessive blood loss, and protect LDL from free radical oxidation into potentially harmful cholesterol oxides. All these actions help to protect against heart disease.

Buckwheat is also a good source of magnesium. This mineral relaxes blood vessels, improving blood flow and nutrient delivery while lowering blood pressure—the perfect combination for a healthy cardiovascular system.

Better Blood Sugar Control and A Lowered Risk of Diabetes

The nutrients in buckwheat may contribute to blood sugar control. In a test that compared the effect on blood sugar of whole buckwheat groats to bread made from refined wheat flour, buckwheat groats significantly lowered blood glucose and insulin responses. Whole buckwheats also scored highest on their ability to satisfy hunger.

When researchers followed almost 36,000 women in Iowa during a six-year long study of the effects of whole grains and the incidence of diabetes, they found that women who consumed an average of 3 servings of whole grains daily had a 21 percent lower risk of diabetes compared to those who ate one serving per week. Because buckwheat is a good source of magnesium, it is also important to note that women who ate the most foods high in magnesium had a 24 percent lower risk of diabetes compared to women who ate the least.

Canadian researchers, publishing their findings in the *Journal of Agricultural and Food Chemistry* have found new evidence that buckwheat may be helpful in the management of diabetes. In a placebo-controlled study, a single dose of buckwheat seed extract lowered blood glucose levels by 12-19% at 90 and 120 minutes after administration when fed to laboratory animals with chemically-induced diabetes. No glucose reduction was seen in animals given placebo. The component in buckwheat responsible for its blood glucose-lowering effects appears to be chiro-inositol, a compound that has been shown in other animal and human studies to play a significant role in glucose metabolism and cell signaling. While researchers do not yet know precisely how it works, preliminary evidence suggests chiro-inositol makes cells more sensitive to insulin and may even act as an insulin mimic. Results of the Canadian study were so promising that one of the lead investigators, Roman Przbylski, is currently collaborating with Canadian-based Kade Research to develop new buckwheat varieties with much higher amounts of chiro-inositol. Although the animals used in this study had the equivalent of Type 1 diabetes in humans, the researchers are confident that buckwheat will exert similar glucose-lowering effects when given to animals with Type 2 diabetes, which is the next study on their agenda. Type 2 or non-insulin dependent diabetes, which is by far the most common form in humans (90% of diabetes in humans is Type 2), is characterized by an inability of cells to respond properly to insulin.

Buckwheat and other whole grains are also rich sources of magnesium, a mineral that acts as a co-factor for more than 300 enzymes, including enzymes involved in the body's use of glucose and insulin secretion.

The FDA permits foods that contain at least 51% whole grains by weight (and are also low in fat, saturated fat, and cholesterol) to display a health claim stating consumption is linked to lower risk of heart disease and certain cancers. Now, research suggests regular consumption of whole grains also reduces risk of type 2 diabetes. (van Dam RM, Hu FB, *Diabetes Care*).

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Helps Prevent Gallstones

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Health-Promoting Potential Equal to or Even Higher than that of Vegetables and Fruits

Research reported at the American Institute for Cancer Research (AICR) International Conference on Food, Nutrition and Cancer, by Rui Hai Liu, M.D., Ph.D., and his colleagues at Cornell University shows that whole grains, such as buckwheat, contain many powerful phytonutrients whose activity has gone unrecognized because research methods have overlooked them.

Despite the fact that for years researchers have been measuring the antioxidant power of a wide array of phytonutrients, they have typically measured only the "free" forms of these substances, which dissolve quickly and are immediately absorbed into the bloodstream. They have not looked at the "bound" forms, which are attached to the walls of plant cells and must be released by intestinal bacteria during digestion before they can be absorbed.

Phenolics, powerful antioxidants that work in multiple ways to prevent disease, are one major class of phytonutrients that have been widely studied. Included in this broad category are such compounds as quercetin, curcumin, ellagic acid, catechins, and many others that appear frequently in the health news.

When Dr. Liu and his colleagues measured the relative amounts of phenolics, and whether they were present in bound or free form, in common fruits and vegetables like apples, red grapes, broccoli and spinach, they found that phenolics in the "free" form averaged 76% of the total number of phenolics in these foods. In whole grains, however, "free" phenolics accounted for less than 1% of the total, while the remaining 99% were in "bound" form.

In his presentation, Dr. Liu explained that because researchers have examined whole grains with the same process used to measure antioxidants in vegetables and fruits&mash;looking for their content of "free" phenolics"—the amount and activity of antioxidants in whole grains has been vastly underestimated.

Despite the differences in fruits', vegetables' and whole grains' content of "free" and "bound" phenolics, the total antioxidant activity in all three types of whole foods is similar, according to Dr. Liu's research. His team measured the antioxidant activity of various foods, assigning each a rating based on a formula (micromoles of vitamin C equivalent per gram). Broccoli and spinach measured 80 and 81, respectively; apple and banana measured 98 and 65; and of the whole grains tested, corn measured 181, whole wheat 77, oats 75, and brown rice 56.

Dr. Liu's findings may help explain why studies have shown that populations eating diets high in fiber-rich whole grains consistently have lower risk for colon cancer, yet short-term clinical trials that have focused on fiber alone in lowering colon cancer risk, often to the point of giving subjects isolated fiber supplements, yield inconsistent results. The explanation is most likely that these studies have not taken into account the interactive effects of all the nutrients in whole grains—not just their fiber, but also their many phytonutrients. As far as whole grains are concerned, Dr. Liu believes that the key to their powerful cancer-fighting potential is precisely their wholeness. A grain of whole wheat consists of three parts—its endosperm (starch), bran and germ. When wheat—or any whole grain—is refined, its bran and germ are removed. Although these two parts make up only 15-17% of the grain's weight, they contain 83% of its phenolics. Dr. Liu says his recent findings on the antioxidant content of whole grains reinforce the message that a variety of foods should be eaten good health. "Different plant foods have different phytochemicals," he said. "These substances go to different organs, tissues and cells, where they perform different functions. What your body needs to ward off disease is this synergistic effect—this teamwork—that is produced by eating a wide variety of plant foods, including whole grains.

Lignans Protect against Heart Disease

One type of phytonutrient especially abundant in whole grains such as buckwheat are plant lignans, which are converted by friendly flora in our intestines into mammalian lignans, including one called enterolactone that is thought to protect against breast and other hormone-dependent cancers as well as heart disease. In addition to whole grains, nuts, seeds and berries are rich sources of plant lignans, and vegetables, fruits, and beverages such as coffee, tea and wine also contain some. When blood levels of enterolactone were measured in 857 postmenopausal women in a Danish study published in the *Journal of Nutrition*, women eating the most whole grains were found to have significantly higher blood levels of this protective lignan. Women who ate more cabbage and leafy vegetables also had higher enterolactone levels.

Significant Cardiovascular Benefits for Postmenopausal Women

Eating a serving of whole grains, such as buckwheat, at least 6 times each week is an especially good idea for postmenopausal women with high cholesterol, high blood pressure or other signs of cardiovascular disease (CVD).

A 3-year prospective study of over 220 postmenopausal women with CVD, published in the *American Heart Journal*, shows that those eating at least 6 servings of whole grains each week experienced both:

- Slowed progression of atherosclerosis, the build-up of plaque that narrows the vessels through which blood flows, and
- Less progression in stenosis, the narrowing of the diameter of arterial passageways.

The women's intake of fiber from fruits, vegetables and refined grains was *not* associated with a lessening in CVD progression.

Prevent Heart Failure with a Whole Grains Breakfast

Heart failure is the leading cause of hospitalization among the elderly in the United States. Success of drug treatment is only partial (ACE inhibitors and beta-blockers are typically used; no evidence has found statins safe or effective for heart failure), and its prognosis remains poor. Follow up of 2445 discharged hospital patients with heart failure revealed that 37.3% died during the first year, and 78.5% died within 5 years.

Since consumption of whole grain products and dietary fiber has been shown to reduce the risk of high blood pressure and heart attack, Harvard researchers decided to look at the effects of cereal consumption on heart failure risk and followed 21,376 participants in the Physicians Health Study over a period of 19.6 years.

After adjusting for confounding factors (age, smoking, alcohol consumption, vegetable consumption, use of vitamins, exercise, and history of heart disease), they found that men who simply enjoyed a daily morning bowl of whole grain (but not refined) cereal had a 29% lower risk of heart failure. Isn't your heart worth protecting, especially when the prescription—a morning bowl of hearty whole grains—is so delicious? For quick, easy, heart-healthy, whole grain recipes, click The World's Healthiest Foods, and look at the "How to Enjoy" section in any of our grain profiles.

Fiber from Whole Grains and Fruit Protective against Breast Cancer

When researchers looked at how much fiber 35,972 participants in the UK Women's Cohort Study ate, they found a diet rich in fiber from whole grains, such as buckwheat, and fruit offered significant protection against breast cancer for pre-menopausal women. (Cade JE, Burley VJ, et al., *International Journal of Epidemiology*).

Pre-menopausal women eating the most fiber (>30 grams daily) more than halved their risk of developing breast cancer, enjoying a 52% lower risk of breast cancer compared to women whose diets supplied the least fiber (<20 grams/day).

Fiber supplied by whole grains offered the most protection. Pre-menopausal women eating the most whole grain fiber (at least 13 g/day) had a 41% reduced risk of breast cancer, compared to those with the lowest whole grain fiber intake (4 g or less per day).

Fiber from fruit was also protective. Pre-menopausal women whose diets supplied the most fiber from fruit (at least 6 g/day) had a 29% reduced risk of breast cancer, compared to those with the lowest fruit fiber intake (2 g or less per day).

Practical Tip: As the following table shows, it's surprisingly easy to enjoy a healthy way of eating that delivers at least 13 grams of whole grain fiber and 6 grams of fiber from fruit each day.

Food	Fiber Content in Grams
Oatmeal, 1 cup	3.98
Whole wheat bread, 1 slice	2
Whole wheat spaghetti, 1 cup	6.3
Brown rice, 1 cup	3.5
Barley, 1 cup	13.6
Buckwheat, 1 cup	4.54
Rye, 1/3 cup	8.22
Corn, 1 cup	4.6
Apple, 1 medium with skin	5.0
Banana, 1 medium	4.0
Blueberries, 1 cup	3.92
Orange, 1 large	4.42
Pear, 1 large	5.02
Prunes, 1/4 cup	3.02
Strawberries, 1 cup	3.82
Raspberries, 1 cup	8.36

*Fiber content can vary between brands. Source: esha Research, Food Processor for Windows, Version 7.8

Additional Research Finds Cereal and Fruit Fiber Protective against Postmenopausal Breast Cancer

Results of a prospective study involving 51,823 postmenopausal women for an average of 8.3 years showed a 34% reduction in breast cancer risk for those consuming the most fruit fiber compared to those consuming the least. In addition, in the subgroup of women who had ever used hormone replacement, those consuming the most fiber, especially cereal fiber, had a 50% reduction in their risk of breast cancer compared to those consuming the least. Int J Cancer. 2008 Jan 15;122(2):403-12.

Fruits richest in fiber include apples, dates, figs, pears and prunes. When choosing a high fiber cereal, look for whole grain cereals as they supply the most bran (a mere 1/3rd cup of bran contains about 14 grams of fiber). With its rich, nutty flavor, buckwheat makes a great breakfast alternative to a bowl of hot oatmeal. A cup of buckwheat delivers 20% of the RDI for fiber for just 154 calories!

Whole Grains and Fish Highly Protective against Childhood Asthma

According to the American Lung Association, almost 20 million Americans suffer from asthma, which is reported to be responsible for over 14 million lost school days in children, and an annual economic cost of more than $16.1 billion.

Increasing consumption of whole grains and fish could reduce the risk of childhood asthma by about 50%, suggests the International Study on Allergy and Asthma in Childhood (Tabak C, Wijga AH, *Thorax*).

The researchers, from the Dutch National Institute of Public Health and the Environment, Utrecht University, University Medical Center Groningen, used food frequency questionnaires completed by the parents of 598 Dutch children aged 8-13 years. They assessed the children's consumption of a range of foods including fish, fruits, vegetables, dairy and whole grain products. Data on asthma and wheezing were also assessed using medical tests as well as questionnaires.

While no association between asthma and intake of fruits, vegetables, and dairy products was found (a result at odds with other studies that have supported a link between antioxidant intake, particularly vitamins C and E, and asthma), the children's intake of both whole grains and fish was significantly linked to incidence of wheezing and current asthma.

In children with a low intake of fish and whole grains, the prevalence of wheezing was almost 20%, but was only 4.2% in children with a high intake of both foods. Low intake of fish and whole grains also correlated with a much higher incidence of current asthma (16.7%). compared to only a 2.8% incidence of current asthma among children with a high intake of both foods.

After adjusting results for possible confounding factors, such as the educational level of the mother, and total energy intake, high intakes of whole grains and fish were found to be associated with a 54 and 66% reduction in the probability of being asthmatic, respectively.

The probability of having asthma with bronchial hyperresponsiveness (BHR), defined as having an increased sensitivity to factors that cause narrowing of the airways, was reduced by 72 and 88% when children had a high-intake of whole grains and fish, respectively. Lead researcher, CoraTabak commented, "The rise in the prevalence of asthma in western societies may be related to changed dietary habits." We agree. The Standard American Diet is sorely deficient in the numerous anti-inflammatory compounds found in fish and whole grains, notably, the omega-3 fats supplied by cold water fish and the magnesium and vitamin E provided by whole grains. One caution: wheat may need to be avoided as it is a common food allergen associated with asthma.

Meta-analysis Explains Whole Grains' Health Benefits

In many studies, eating whole grains, such as buckwheat, has been linked to protection against atherosclerosis, ischemic stroke, diabetes, insulin resistance, obesity, and premature death. A new study and accompanying editorial, published in the American Journal of Clinical Nutrition explains the likely reasons behind these findings and recommends at least 3 servings of whole grains should be eaten daily.

Whole grains are concentrated sources of fiber. In this meta-analysis of 7 studies including more than 150,000 persons, those whose diets provided the highest dietary fiber intake had a 29% lower risk of cardiovascular disease compared to those with the lowest fiber intake.

But it's not just fiber's ability to serve as a bulking agent that is responsible for its beneficial effects as a component of whole grains. Wheat bran, for example, which constitutes 15% of most whole-grain wheat kernels but is virtually non-existent in refined wheat flour, is rich in minerals, antioxidants, lignans, and other phytonutrients—as well as in fiber.

In addition to the matrix of nutrients in their dietary fibers, the whole-grain arsenal includes a wide variety of additional nutrients and phytonutrients that reduce the risk of cardiovascular disease. Compounds in whole grains that have cholesterol-lowering effects include polyunsaturated fatty acids, oligosaccharides, plant sterols and stanols, and saponins.

Whole grains are also important dietary sources of water-soluble, fat-soluble, and insoluble antioxidants. The long list of cereal antioxidants includes vitamin E, tocotrieonols, selenium, phenolic acids, and phytic acid. These multifunctional antioxidants come in immediate-release to slow-release forms and thus are available throughout the gastrointestinal tract over a long period after being consumed.

The high antioxidant capacity of wheat bran, for example, is 20-fold that of refined wheat flour (endosperm). Although the role of antioxidant supplements in protecting against cardiovascular disease has been questioned, prospective population studies consistently suggest that when consumed in whole foods, antioxidants are associated with significant protection against cardiovascular disease. Because free radical damage to cholesterol appears to contribute significantly to the development of atherosclerosis, the broad range of antioxidant activities from the phytonutrients abundant in whole-grains is thought to play a strong role in their cardio-protective effects.

Like soybeans, whole grains are good sources of phytoestrogens, plant compounds that may affect blood cholesterol levels, blood vessel elasticity, bone metabolism, and many other cellular metabolic processes.

Whole grains are rich sources of lignans that are converted by the human gut to enterolactone and enterodiole. In studies of Finnish men, blood levels of enterolactone have been found to have an inverse relation not just to cardiovascular-related death, but to all causes of death, which suggests that the plant lignans in whole grains may play an important role in their protective effects.

Lower insulin levels may also contribute to the protective effects of whole grains. In many persons, the risks of atherosclerotic cardiovascular disease, diabetes, and obesity are linked to insulin resistance. Higher intakes of whole grains are associated with increased sensitivity to insulin in population studies and clinical trials. Why? Because whole grains improve insulin sensitivity by lowering the glycemic index of the diet while increasing its content of fiber, magnesium, and vitamin E.

The whole kernel of truth: as part of your healthy way of eating, whole grains, such as buckwheat, can significantly lower your risk of cardiovascular disease, obesity and type 2 diabetes.

The 2005 Dietary Guidelines for Americans recommends at least 3 servings of whole-grain foods each day, but experts say most Americans eat less than a single serving. Don't be part of this majority! No idea how to cook whole grains? Just look at the "How to Enjoy" section in our profiles of the whole grains, or for quick, easy, delicious recipes, click on this link to our Recipe Assistant and select the whole grain you would like to prepare.

Description

While many people think that buckwheat is a cereal grain, it is actually a fruit seed that is related to rhubarb and sorrel. (We classify it as a grain on our website because it categorized as such from a culinary perspective.) Common and tartary buckwheat are the varieties that are popular in the United States. Its name is supposedly derived from the Dutch word *bockweit*, which means "beech wheat," reflecting buckwheat's beechnut-like shape and its wheat-like characteristics. Buckwheat flowers are very fragrant and are attractive to bees that use them to produce a special, strongly flavored, dark honey.

While buckwheat is of similar size to wheat kernels, it features a unique triangular shape. In order to be edible, the outer hull must be removed, a process that requires special milling equipment due to its unusual shape. Buckwheat is sold either unroasted or roasted, the latter oftentimes called "kasha," from which a traditional European dish is made. Unroasted buckwheat has a soft, subtle flavor, while roasted buckwheat has more of an earthy, nutty taste. Its color ranges from tannish-pink to brown. Buckwheat is often served as a rice alternative or porridge.

Buckwheat is also ground into flour, available in either light or dark forms, with the darker variety being more nutritious. Since buckwheat does not contain gluten, it is often mixed with some type of gluten-containing flour (such as wheat) for baking. In the United States, buckwheat flour is often used to make buckwheat pancakes, a real delight, especially for those allergic to wheat.

History

Buckwheat is native to Northern Europe as well as Asia. From the 10th through the 13th century, it was widely cultivated in China. From there, it spread to Europe and Russia in the 14th and 15th centuries, and was introduced in the United States by the Dutch during the 17th century.

Buckwheat is widely produced in Russia and Poland, where it plays an important role in their traditional cuisines. Other countries where buckwheat is cultivated commercially include the United States, Canada, and France, the country famous for its buckwheat crepes.

How to Select and Store

Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the buckwheat are covered and that the store has a good product turnover to ensure its maximal freshness. Whether purchasing buckwheat in bulk or in a packaged container, make sure there is no evidence of moisture.

Place buckwheat in an airtight container and store in a cool dry place. Buckwheat flour should be always stored in the refrigerator, while other buckwheat products should be kept refrigerated if you live in a warm climate or during periods of warmer weather. Stored properly, whole buckwheat can last up to one year, while the flour will keep fresh for several months.

How to Enjoy

A Few Quick Serving Ideas

- Combine buckwheat flour with whole wheat flour to make delicious breads, muffins and pancakes.
- Cook up a pot of buckwheat for a change of pace from hot oatmeal as a delicious hearty breakfast cereal.
- Add cooked buckwheat to soups or stews to give them a hardier flavor and deeper texture.
- Add chopped chicken, garden peas, pumpkin seeds and scallions to cooked and cooled buckwheat for a delightful lunch or dinner salad.

For some of our favorite recipes, click Recipes.

Safety

Buckwheat can be safely eaten by people who have celiac disease as it does not contain gluten. Buckwheat can be a good substitute for wheat, oats, rye and barley in a gluten-free diet.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Buckwheat, groats, cooked
1.00 cup
168.00 grams
Calories: 155
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
manganese	0.68 mg	34	4.0	very good
copper	0.25 mg	28	3.2	good
magnesium	85.68 mg	21	2.5	good
fiber	4.54 g	18	2.1	good
phosphorus	117.60 mg	17	2.0	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
	DRI/DV>=25% OR

good	Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Millet

Although millet is most often associated as the main ingredient in bird seed, it is not just "for the birds." Creamy like mashed potatoes or fluffy like rice, millet is a delicious grain that can accompany many types of food. As with most grains, millet is available in markets throughout the year.

Millet is tiny in size and round in shape and can be white, gray, yellow or red. The most widely available form of millet found in stores is the hulled variety, although traditional couscous made from cracked millet can also be found. The term millet refers to a variety of grains, some of which do not belong to the same genus.

Millet, cooked
1.00 cup
(174.00 grams)

Calories: 207
GI: medium

Nutrient	DRI/DV
copper	31%
phosphorus	25%
manganese	24%
magnesium	19%

Health Benefits

Millet is more than just an interesting alternative to the more common grains. Our food ranking system qualified it as a good source of some very important nutrients, including copper, manganese, phosphorus, and magnesium.

Heart-Protective Properties

Although oats have been widely publicized for their heart-protective properties, millet is a grain that should also be included on your list of heart-healthy choices because of its status as a good source of magnesium. Magnesium has been shown in studies to reduce the severity of asthma and to reduce the frequency of migraine attacks. Magnesium has also been shown to lower high blood pressure and reduce the risk of heart attack, especially in people with atherosclerosis or diabetic heart disease.

Development and Repair of Body Tissue

The phosphorus provided by millet plays a role in the structure of every cell in the body. In addition to its role in forming the mineral matrix of bone, phosphorus is an essential component of numerous other life-critical compounds including *adenosine triphosphate* or ATP, the molecule that is the energy currency of the body. Phosphorus is an important component of nucleic acids, the building blocks of the genetic code. In addition, the metabolism of lipids (fats) relies on phosphorus, and phosphorus is an essential component of lipid-containing structures such as cell membranes and nervous system structures.

Millet and Other Whole Grains Substantially Lower Type 2 Diabetes Risk

Millet and other whole grains are a rich source of magnesium, a mineral that acts as a co-factor for more than 300 enzymes, including enzymes involved in the body's use of glucose and insulin secretion.

The FDA permits foods that contain at least 51% whole grains by weight (and are also low in fat, saturated fat, and cholesterol) to display a health claim stating consumption is linked to lower risk of heart disease and certain cancers. Now, research suggests regular consumption of whole grains also reduces risk of type 2 diabetes. (van Dam RM, Hu FB, *Diabetes Care*).

In this 8-year trial, involving 41,186 particpants of the Black Women's Health Study, research data confirmed inverse associations between magnesium, calcium and major food sources in relation to type 2 diabetes that had already been reported in predominantly white populations.

Risk of type 2 diabetes was 31% lower in black women who frequently ate whole grains compared to those eating the least of these magnesium-rich foods. When the women's dietary intake of magnesium intake was considered by itself, a beneficial, but lesser—19%—reduction in risk of type 2 diabetes was found, indicating that whole grains offer special benefits in promoting healthy blood sugar control. Daily consumption of low-fat dairy foods was also helpful, lowering risk of type 2 diabetes by 13%. Enjoy a hearty breakfast and get the benefits of both millet and dairy by serving a hot bowl of millet topped with low-fat milk and your favorite dried fruit, nuts or seeds.

Helps Prevent Gallstones

Eating foods high in insoluble fiber, such as millet, can help women avoid gallstones, shows a study published in the *American Journal of Gastroenterology*.

Studying the overall fiber intake and types of fiber consumed over a 16 year period by over 69,000 women in the Nurses Health Study, researchers found that those consuming the most fiber overall (both soluble and insoluble) had a 13% lower risk of developing gallstones compared to women consuming the fewest fiber-rich foods.

Those eating the most foods rich in insoluble fiber gained even more protection against gallstones: a 17% lower risk compared to women eating the least. And the protection was dose-related; a 5-gram increase in insoluble fiber intake dropped risk dropped 10%.

How do foods rich in insoluble fiber help prevent gallstones? Researchers think insoluble fiber not only speeds intestinal transit time (how quickly food moves through the intestines), but reduces the secretion of bile acids (excessive amounts contribute to gallstone formation), increases insulin sensitivity and lowers triglycerides (blood fats). Abundant in all whole grains, insoluble fiber is also found in nuts and the edible skin of fruits and vegetables including tomatoes, cucumbers, many squash, apples, berries, and pears. In addition, beans provide insoluble as well as soluble fiber.

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Apple, 1 medium with skin	5.0
Banana, 1 medium	4.0
Blueberries, 1 cup	3.92
Orange, 1 large	4.42
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*Fiber content can vary between brands. Source: esha Research, Food Processor for Windows, Version 7.8

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The researchers, from the Dutch National Institute of Public Health and the Environment, Utrecht University, University Medical Center Groningen, used food frequency questionnaires completed by the parents of 598 Dutch children aged 8-13 years. They assessed the children's consumption of a range of foods including fish, fruits, vegetables, dairy and whole grain products. Data on asthma and wheezing were also assessed using medical tests as well as questionnaires.

While no association between asthma and intake of fruits, vegetables, and dairy products was found (a result at odds with other studies that have supported a link between antioxidant intake, particularly vitamins C and E, and asthma), the children's intake of both whole grains and fish was significantly linked to incidence of wheezing and current asthma.

In children with a low intake of fish and whole grains, the prevalence of wheezing was almost 20%, but was only 4.2% in children with a high intake of both foods. Low intake of fish and whole grains also correlated with a much higher incidence of current asthma (16.7%). compared to only a 2.8% incidence of current asthma among children with a high intake of both foods.

After adjusting results for possible confounding factors, such as the educational level of the mother, and total energy intake, high intakes of whole grains and fish were found to be associated with a 54 and 66% reduction in the probability of being asthmatic, respectively.

The probability of having asthma with bronchial hyperresponsiveness (BHR), defined as having an increased sensitivity to factors that cause narrowing of the airways, was reduced by 72 and 88% when children had a high-intake of whole grains and fish, respectively. Lead researcher, CoraTabak commented, "The rise in the prevalence of asthma in western societies may be related to changed dietary habits." We agree. The Standard American Diet is sorely deficient in the numerous anti-inflammatory compounds found in fish and whole grains, notably, the omega-3 fats supplied by cold water fish and the magnesium and vitamin E provided by whole grains. One caution: wheat may need to be avoided as it is a common food allergen associated with asthma.

Health-Promoting Activity Equal to or Even Higher than that of Vegetables and Fruits

Research reported at the American Institute for Cancer Research (AICR) International Conference on Food, Nutrition and Cancer, by Rui Hai Liu, M.D., Ph.D., and his colleagues at Cornell University shows that whole grains, such as millet, contain many powerful phytonutrients whose activity has gone unrecognized because research methods have overlooked them.

Despite the fact that for years researchers have been measuring the antioxidant power of a wide array of phytonutrients, they have typically measured only the "free" forms of these substances, which dissolve quickly and are immediately absorbed into the bloodstream. They have not looked at the "bound" forms, which are attached to the walls of plant cells and must be released by intestinal bacteria during digestion before they can be absorbed.

Phenolics, powerful antioxidants that work in multiple ways to prevent disease, are one major class of phytonutrients that have been widely studied. Included in this broad category are such compounds as quercetin, curcumin, ellagic acid, catechins, and many others that appear frequently in the health news.

When Dr. Liu and his colleagues measured the relative amounts of phenolics, and whether they were present in bound or free form, in common fruits and vegetables like apples, red grapes, broccoli and spinach, they found that phenolics in the "free" form averaged 76% of the total number of phenolics in these foods. In whole grains, however, "free" phenolics accounted for less than 1% of the total, while the remaining 99% were in "bound" form.

In his presentation, Dr. Liu explained that because researchers have examined whole grains with the same process used to measure antioxidants in vegetables and fruits—looking for their content of "free" phenolics"—the amount and activity of antioxidants in whole grains has been vastly underestimated.

Despite the differences in fruits', vegetables' and whole grains' content of "free" and "bound" phenolics, the total antioxidant activity in all three types of whole foods is similar, according to Dr. Liu's research. His team measured the antioxidant activity of various foods, assigning each a rating based on a formula (micromoles of vitamin C equivalent per gram). Broccoli and spinach measured 80 and 81, respectively; apple and banana measured 98 and 65; and of the whole grains tested, corn measured 181, whole wheat 77, oats 75, and brown rice 56.

Dr. Liu's findings may help explain why studies have shown that populations eating diets high in fiber-rich whole grains consistently have lower risk for colon cancer, yet short-term clinical trials that have focused on fiber alone in lowering colon cancer risk, often to the point of giving subjects isolated fiber supplements, yield inconsistent results. The explanation is most likely that these studies have not taken into account the interactive effects of all the nutrients in whole grains—not just their fiber, but also their many phytonutrients. As far as whole grains are concerned, Dr. Liu believes that the key to their powerful cancer-fighting potential is precisely their wholeness. A grain of whole wheat consists of three parts—its endosperm (starch), bran and germ. When wheat—or any whole grain—is refined, its bran and germ are removed. Although these two parts make up only 15-17% of the grain's weight, they contain 83% of its phenolics. Dr. Liu says his recent findings on the antioxidant content of whole grains reinforce the message that a variety of foods should be eaten good health. "Different plant foods have different phytochemicals," he said. "These substances go to different organs, tissues and cells, where they perform different functions. What your body needs to ward off disease is this synergistic effect—this teamwork—that is produced by eating a wide variety of plant foods, including whole grains."

Lignans Protect against Heart Disease

One type of phytonutrient especially abundant in whole grains including millet are plant lignans, which are converted by friendly flora in our intestines into mammalian lignans, including one called enterolactone that is thought to protect against breast and other hormone-dependent cancers as well as heart disease. In addition to whole grains, nuts, seeds and berries are rich sources of plant lignans, and vegetables, fruits, and beverages such as coffee, tea and wine also contain some. When blood levels of enterolactone were measured in over 800 postmenopausal women in a Danish study published in the *Journal of Nutrition*, women eating the most whole grains were found to have significantly higher blood levels of this protective lignan. Women who ate more cabbage and leafy vegetables also had higher enterolactone levels.

Significant Cardiovascular Benefits for Postmenopausal Women

Eating a serving of whole grains, such as millet, at least 6 times each week is an especially good idea for postmenopausal women with high cholesterol, high blood pressure or other signs of cardiovascular disease (CVD).

A 3-year prospective study of 229 postmenopausal women with CVD, published in the *American Heart Journal*, shows that those eating at least 6 servings of whole grains each week experienced both:

- Slowed progression of atherosclerosis, the build-up of plaque that narrows the vessels through which blood flows, and
- Less progression in stenosis, the narrowing of the diameter of arterial passageways.

The women's intake of fiber from fruits, vegetables and refined grains was *not* associated with a lessening in CVD progression.

Prevent Heart Failure with a Whole Grains Breakfast

Heart failure is the leading cause of hospitalization among the elderly in the United States. Success of drug treatment is only partial (ACE inhibitors and beta-blockers are typically used; no evidence has found statins safe or effective for heart failure), and its prognosis remains poor. Follow up of 2445 discharged hospital patients with heart failure revealed that 37.3% died during the first year, and 78.5% died within 5 years.

Since consumption of whole grain products and dietary fiber has been shown to reduce the risk of high blood pressure and heart attack, Harvard researchers decided to look at the effects of cereal consumption on heart failure risk and followed 21,376 participants in the Physicians Health Study over a period of 19.6 years.

After adjusting for confounding factors (age, smoking, alcohol consumption, vegetable consumption, use of vitamins, exercise, and history of heart disease), they found that men who simply enjoyed a daily morning bowl of whole grain (but not refined) cereal had a 29% lower risk of heart failure. Isn't your heart worth protecting, especially when the prescription—a morning bowl of hearty whole grains—is so delicious? For quick, easy, heart-healthy, whole grain recipes, click The World's Healthiest Foods, and look at the "How to Enjoy" section in any of our grain profiles.

Meta-analysis Explains Whole Grains' Health Benefits

In many studies, eating whole grains, such as millet, has been linked to protection against atherosclerosis, ischemic stroke, diabetes, insulin resistance, obesity, and premature death. A new study and accompanying editorial, published in the American Journal of Clinical Nutrition explains the likely reasons behind these findings and recommends at least 3 servings of whole grains should be eaten daily.

Whole grains are concentrated sources of fiber. In this meta-analysis of 7 studies including more than 150,000 persons, those whose diets provided the highest dietary fiber intake had a 29% lower risk of cardiovascular disease compared to those with the lowest fiber intake.

But it's not just fiber's ability to serve as a bulking agent that is responsible for its beneficial effects as a component of whole grains. Wheat bran, for example, which constitutes 15% of most whole-grain wheat kernels but is virtually non-existent in refined wheat flour, is rich in minerals, antioxidants, lignans, and other phytonutrients;mdash;as well as in fiber.

In addition to the matrix of nutrients in their dietary fibers, the whole-grain arsenal includes a wide variety of additional nutrients and phytonutrients that reduce the risk of cardiovascular disease. Compounds in whole grains that have cholesterol-lowering effects include polyunsaturated fatty acids, oligosaccharides, plant sterols and stanols, and saponins.

Whole grains are also important dietary sources of water-soluble, fat-soluble, and insoluble antioxidants. The long list of cereal antioxidants includes vitamin E, tocotrieonols, selenium, phenolic acids, and phytic acid. These multifunctional antioxidants come in immediate-release to slow-release forms and thus are available throughout the gastrointestinal tract over a long period after being consumed.

The high antioxidant capacity of wheat bran, for example, is 20-fold that of refined wheat flour (endosperm). Although the role of antioxidant supplements in protecting against cardiovascular disease has been questioned, prospective population studies consistently suggest that when consumed in whole foods, antioxidants are associated with significant protection against cardiovascular disease. Because free radical damage to cholesterol appears to contribute significantly to the development of atherosclerosis, the broad range of antioxidant activities from the phytonutrients abundant in whole-grains is thought to play a strong role in their cardio-protective effects.

Like soybeans, whole grains are rich sources of phytoestrogens, plant compounds that may affect blood cholesterol levels, blood vessel elasticity, bone metabolism, and many other cellular metabolic processes.

Whole grains are rich sources of lignans that are converted by the human gut to enterolactone and enterodiole. In studies of Finnish men, blood levels of enterolactone have been found to have an inverse relation not just to cardiovascular-related death, but to all causes of death, which suggests that the plant lignans in whole grains may play an important role in their protective effects.

Lower insulin levels may also contribute to the protective effects of whole grains. In many persons, the risks of atherosclerotic cardiovascular disease, diabetes, and obesity are linked to insulin resistance. Higher intakes of whole grains are associated with increased sensitivity to insulin in population studies and clinical trials. Why? Because whole grains improve insulin sensitivity by lowering the glycemic index of the diet while increasing its content of fiber, magnesium, and vitamin E.

The whole kernel of truth: as part of your healthy way of eating, whole grains, such as millet, can significantly lower your risk of cardiovascular disease, obesity and type 2 diabetes.

The 2005 Dietary Guidelines for Americans recommends at least 3 servings of whole-grain foods each day, but experts say most Americans eat less than a single serving. Don't be part of this majority! No idea how to cook whole grains? Just look at the "How to Enjoy" section in our profiles of the whole grains, or for quick, easy, delicious recipes, click on this link to our Recipe Assistant and select whichever whole grain you would like to prepare.

Description

While you will probably recognize millet as being one of the main ingredients in birdseed, this wonderful grain is anything but "for the birds." (Millet is technically a seed and not a grain but we classify it as a grain on our website since that is what it is categorized as from a culinary perspective.) It is a delicious grain whose consistency varies depending upon cooking method; it can be creamy like mashed potatoes or fluffy like rice. Additionally, since millet does not contain gluten, it is a wonderful grain alternative for people who are gluten-sensitive.

Millet is tiny in size and round in shape and can vary in color from white to gray to yellow to red. The most widely available form of millet found in stores is the hulled type, although oftentimes you may be able to find traditional couscous, which is made from cracked millet.

The term millet refers to a variety of grains, some of which do not belong to the same genus of plant. The types of millet consumed as food generally fall into the scientific categories *Panicum miliaceuem* or *Setaria italica*.

History

Millet is thought to have originated in North Africa, specifically in Ethiopia, where it has been consumed since prehistoric times. There is even mention of millet in the Bible as an ingredient for unleavened bread. Millet is still an extremely important food staple in many Africa countries.

Since ancient times, millet has been widely consumed in Asia and India as well. The Indian flatbread *roti* is made from ground millet seeds. In the Middle Ages, before potatoes and corn were introduced, millet became a staple grain in Europe, especially in countries in Eastern Europe. The Setaria variety of millet was introduced into the United States in the 19th century. While millet has been used primarily for birdseed and livestock fodder in Western Europe and North America, it is now gaining popularity as a delicious and nutritious grain that can be enjoyed for both its unique virtues as well as the fact that it is a gluten-free grain alternative to wheat.

The majority of the world's commercial millet crop is produced by India, China and Nigeria.

How to Select and Store

Millet is generally available in its hulled and whole-grain form. It is available prepackaged as well as in bulk containers. Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the millet are covered and that the store has a good product turnover so as to ensure its maximal freshness. Whether purchasing millet in bulk or in a packaged container, make sure that there is no evidence of moisture.

Store millet in an airtight container in a cool, dry and dark place, where it will keep for several months.

How to Enjoy

A Few Quick Serving Ideas

- Cooked millet can be served as a breakfast porridge to which you can add your favorite nuts and fruits.
- Ground millet can be added to bread and muffin recipes.
- Toss cooked and chilled millet with your favorite chopped vegetables and either chicken or baked tofu cubes. Add dressing and voilá ..... an easy to prepare, delicious meal.
- Next time you are looking for an alternative to rice or potatoes, serve millet instead.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating.

Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Millet, cooked
1.00 cup
174.00 grams

Calories: 207
GI: medium

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
copper	0.28 mg	31	2.7	good
phosphorus	174.00 mg	25	2.2	good
manganese	0.47 mg	24	2.0	good
magnesium	76.56 mg	19	1.7	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Oats

What better way to gain the strength and energy to carry you through a hectic morning schedule than with a steaming bowl of freshly cooked oatmeal. Oats are harvested in the fall but are available throughout the year and can add extra nutrition to a variety of healthy dishes.

Oats, known scientifically as Avena sativa, are a hardy cereal grain able to withstand poor soil conditions in which other crops are unable to thrive. Oats gain part of their distinctive flavor from the roasting process that they undergo after being harvested and cleaned. Although oats are then hulled, this process does not strip away their bran and germ allowing them to retain a concentrated source of their fiber and nutrients.

Oats, unprocessed, dry
0.25 cup
(39.00 grams)

Calories: 152
GI: low

Nutrient	DRI/DV
manganese	96%
molybdenum	64%
phosphorus	29%
copper	27%
biotin	26%
vitamin B1	25%
magnesium	17%
fiber	17%
chromium	15%
zinc	14%
protein	13%

Health Benefits

Lower Cholesterol Levels

A steaming bowl of fresh cooked oatmeal is the perfect way to start off your day, especially if you are trying to prevent or are currently dealing with heart disease or diabetes. Oats, oat bran, and oatmeal contain a specific type of fiber known as *beta-glucan*. Since 1963, study after study has proven the beneficial effects of this special fiber on cholesterol levels. Studies show that in individuals with high cholesterol (above 220 mg/dl), consuming just 3 grams of soluble oat fiber per day (an amount found in one bowl of oatmeal) typically lowers total cholesterol by 8-23%. This is highly significant since each 1% drop in serum cholesterol translates to a 2% decrease in the risk of developing heart disease. High cholesterol levels correlate with the build up of plaques in blood vessel walls. If these plaques become damaged or simply grow too large, they can rupture, blocking a blood vessel and causing a heart attack, stroke, or blood clots elsewhere in the body. Lowering high cholesterol levels can therefore significantly reduce the risk of cardiovascular disease and stroke.

A study published in the *Archives of Internal Medicine* confirms that eating high fiber foods, such as oats, helps prevent heart disease. Almost 10,000 American adults participated in this study and were followed for 19 years. People eating the most fiber, 21 grams per day, had 12% less coronary heart disease (CHD) and 11% less cardiovascular disease (CVD) compared to those eating the least, 5 grams daily. Those eating the most water-soluble dietary fiber fared even better with a 15% reduction in risk of CHD and a 10% risk reduction in CVD.

Unique Oat Antioxidants Reduce Risk of Cardiovascular Disease

Oats, via their high fiber content, are already known to help remove cholesterol from the digestive system that would otherwise end up in the bloodstream. Now, the latest research suggests they may have another cardio-protective mechanism.

Antioxidant compounds unique to oats, called avenanthramides, help prevent free radicals from damaging LDL cholesterol, thus reducing the risk of cardiovascular disease, suggests a study conducted at Tufts University and published in *The Journal of Nutrition*.

In this study, laboratory animals were fed saline containing 0.25 grams of phenol-rich oat bran, after which blood samples were taken at intervals from 20 to 120 minutes. After 40 minutes, blood concentrations of avenanthramides had peaked, showing these compounds were bioavailable (able to be absorbed).

Next, the researchers tested the antioxidant ability of avenanthramides to protect LDL cholesterol against oxidation (free radical damage) induced by copper. Not only did the avenanthramides increase the amount of time before LDL became oxidized, but when vitamin C was added, the oat phenols interacted synergistically with the vitamin, extending the time during which LDL was protected from 137 to 216 minutes.

In another study also conducted at Tufts and published in *Atherosclerosis*, researchers exposed human arterial wall cells to purified avenenthramides from oats for 24 hours, and found that these oat phenols significantly suppressed the production of several types of molecules involved in the attachment of monocytes (immune cells in the bloodstream) to the arterial wall—the first step in the development of atherosclerosis.

Oat avenanthamides suppressed production of ICAM-1 (intracellular adhesion molecule-1) and VCAM-1 (vascular adhesion molecule-1), E-selectin, and the secretion of pro-inflammatory cytokines KL-6, chemokines IL-8 and protein MCP-1 (monocyte chemoattractant protein). Our advice: Cut an orange (which is rich in vitamin C) in quarters or pour yourself a glass of orange juice to enjoy along with your oatmeal. If you prefer some other grain for your breakfast cereal, top it with a heaping spoonful of oat bran.

Prevent Heart Failure with a Whole Grains Breakfast

Heart failure is the leading cause of hospitalization among the elderly in the United States. Success of drug treatment is only partial (ACE inhibitors and beta-blockers are typically used; no evidence has found statins safe or effective for heart failure), and its prognosis remains poor. Follow up of 2445 discharged hospital patients with heart failure revealed that 37.3% died during the first year, and 78.5% died within 5 years. Arch Intern Med. 2007 Mar 12;167(5):490-6.;Eur Heart J. 2006 Mar;27(6):641-3.

Since consumption of whole grain products and dietary fiber has been shown to reduce the risk of high blood pressure and heart attack, Harvard researchers decided to look at the effects of cereal consumption on heart failure risk and followed 21,376 participants in the Physicians Health Study over a period of 19.6 years. After adjusting for confounding factors (age, smoking, alcohol consumption, vegetable consumption, use of vitamins, exercise, and history of heart disease), they found that men who simply enjoyed a daily morning bowl of whole grain (but not refined) cereal had a 29% lower risk of heart failure. Arch Intern Med. 2007 Oct 22;167(19):2080-5. Isn't your heart worth protecting, especially when the prescription—a morning bowl of hearty whole grains—is so delicious? For quick, easy, heart-healthy, whole grain recipes, click The World's Healthiest Foods, and look at the "How to Enjoy" section in any of our grain profiles.

Significant Cardiovascular Benefits for Postmenopausal Women

Eating a serving of whole grains, such as oats, at least 6 times each week is an especially good idea for postmenopausal women with high cholesterol, high blood pressure or other signs of cardiovascular disease (CVD).

A 3-year prospective study of over 200 postmenopausal women with CVD, published in the *American Heart Journal*, shows that those eating at least 6 servings of whole grains each week experienced both:

- Slowed progression of atherosclerosis, the build-up of plaque that narrows the vessels through which blood flows, and
- Less progression in stenosis, the narrowing of the diameter of arterial passageways.

The women's intake of fiber from fruits, vegetables and refined grains was *not* associated with a lessening in CVD progression.

Enhance Immune Response to Infection

In laboratory studies reported in *Surgery*, beta-glucan significantly enhanced the human immune system's response to bacterial infection. Beta-glucan not only helps neutrophils (the most abundant type of non-specific immune cell) navigate to the site of an infection more quickly, it also enhances their ability to eliminate the bacteria they find there.

According to study leader Jonathan Reichner of the Department of Surgery at Rhode Island Hospital and Brown University, priming neutrophils with beta-glucan helps these immune defenders quickly locate the bacterial mother lode within infected tissue. And this more rapid response to infection results in faster microbial clearance and healing. Since our non-specific immune defenses are the body's first strike forces against invading pathogens, starting your day with a bowl of oatmeal may boost your immune response in addition to your morning energy levels.

Stabilize Blood Sugar

Studies also show that beta-glucan has beneficial effects in diabetes as well. Type 2 diabetes patients given foods high in this type of oat fiber or given oatmeal or oat bran rich foods experienced much lower rises in blood sugar compared to those who were given white rice or bread. Starting out your day with a blood sugar stabilizing food such as oats may make it easier to keep blood sugar levels under control the rest of the day, especially when the rest of your day is also supported with nourishing fiber-rich foods.

Oats and Other Whole Grains Substantially Lower Type 2 Diabetes Risk

Oats and other whole grains are a rich source of magnesium, a mineral that acts as a co-factor for more than 300 enzymes, including enzymes involved in the body's use of glucose and insulin secretion.

The FDA permits foods that contain at least 51% whole grains by weight (and are also low in fat, saturated fat, and cholesterol) to display a health claim stating consumption is linked to lower risk of heart disease and certain cancers. Now, research suggests regular consumption of whole grains also reduces risk of type 2 diabetes. (van Dam RM, Hu FB, *Diabetes Care*).

In this 8-year trial, involving 41,186 particpants of the Black Women's Health Study, research data confirmed inverse associations between magnesium, calcium and major food sources in relation to type 2 diabetes that had already been reported in predominantly white populations.

Risk of type 2 diabetes was 31% lower in black women who frequently ate whole grains compared to those eating the least of these magnesium-rich foods. When the women's dietary intake of magnesium intake was considered by itself, a beneficial, but lesser—19%—reduction in risk of type 2 diabetes was found, indicating that whole grains offer special benefits in promoting healthy blood sugar control. Daily consumption of low-fat dairy foods was also helpful, lowering risk of type 2 diabetes by 13%. Enjoy a hearty breakfast and get the benefits of both oats and dairy by serving hot oatmeal, spiced with cinnamon, and topped with handful of walnuts and low-fat milk.

Fiber from Whole Grains and Fruit Protective against Breast Cancer

When researchers looked at how much fiber 35,972 participants in the UK Women's Cohort Study ate, they found a diet rich in fiber from whole grains, such as oats, and fruit offered significant protection against breast cancer for pre-menopausal women. (Cade JE, Burley VJ, et al., *International Journal of Epidemiology*).

Pre-menopausal women eating the most fiber (>30 grams daily) more than halved their risk of developing breast cancer, enjoying a 52% lower risk of breast cancer compared to women whose diets supplied the least fiber (<20 grams/day).

Fiber supplied by whole grains offered the most protection. Pre-menopausal women eating the most whole grain fiber (at least 13 g/day) had a 41% reduced risk of breast cancer, compared to those with the lowest whole grain fiber intake (4 g or less per day).

Fiber from fruit was also protective. Pre-menopausal women whose diets supplied the most fiber from fruit (at least 6 g/day) had a 29% reduced risk of breast cancer, compared to those with the lowest fruit fiber intake (2 g or less per day).

Practical Tip: As the following table shows, it's surprisingly easy to enjoy a healthy way of eating that delivers at least 13 grams of whole grain fiber and 6 grams of fiber from fruit each day.

Food	Fiber Content in Grams
Oatmeal, 1 cup	3.98
Whole wheat bread, 1 slice	2
Whole wheat spaghetti, 1 cup	6.3
Brown rice, 1 cup	3.5
Barley, 1 cup	13.6
Buckwheat, 1 cup	4.54
Rye, 1/3 cup	8.22

Corn, 1 cup	4.6
Apple, 1 medium with skin	5.0
Banana, 1 medium	4.0
Blueberries, 1 cup	3.92
Orange, 1 large	4.42
Pear, 1 large	5.02
Prunes, 1/4 cup	3.02
Strawberries, 1 cup	3.82
Raspberries, 1 cup	8.36

*Fiber content can vary between brands. Source: esha Research, Food Processor for Windows, Version 7.8

Cereal and Fruit Fiber Protective against Postmenopausal Breast Cancer

Results of a prospective study involving 51,823 postmenopausal women for an average of 8.3 years showed a 34% reduction in breast cancer risk for those consuming the most fruit fiber compared to those consuming the least. In addition, in the subgroup of women who had ever used hormone replacement, those consuming the most fiber, especially cereal fiber, had a 50% reduction in their risk of breast cancer compared to those consuming the least. Int J Cancer. 2008 Jan 15;122(2):403-12.

Fruits richest in fiber include apples, dates, figs, pears and prunes. When choosing a high fiber cereal, look for whole grain cereals as they supply the most bran (a mere 1/3rd cup of bran contains about 14 grams of fiber). A cup of oatmeal delivers 15% of the RDI for fiber. Start out your day with a bowl of hot oatmeal or if you prefer cold cereal, oatmeal granola, and you'll be well on your way to meeting your daily RDI for fiber.

Whole Grains and Fish Highly Protective against Childhood Asthma

According to the American Lung Association, almost 20 million Americans suffer from asthma, which is reported to be responsible for over 14 million lost school days in children, and an annual economic cost of more than $16.1 billion.

Increasing consumption of whole grains and fish could reduce the risk of childhood asthma by about 50%, suggests the International Study on Allergy and Asthma in Childhood (Tabak C, Wijga AH, *Thorax*).

The researchers, from the Dutch National Institute of Public Health and the Environment, Utrecht University, University Medical Center Groningen, used food frequency questionnaires completed by the parents of 598 Dutch children aged 8-13 years. They assessed the children's consumption of a range of foods including fish, fruits, vegetables, dairy and whole grain products. Data on asthma and wheezing were also assessed using medical tests as well as questionnaires.

While no association between asthma and intake of fruits, vegetables, and dairy products was found (a result at odds with other studies that have supported a link between antioxidant intake, particularly vitamins C and E, and asthma), the children's intake of both whole grains and fish was significantly linked to incidence of wheezing and current asthma.

In children with a low intake of fish and whole grains, the prevalence of wheezing was almost 20%, but was only 4.2% in children with a high intake of both foods. Low intake of fish and whole grains also correlated with a much higher incidence of current asthma (16.7%). compared to only a 2.8% incidence of current asthma among children with a high intake of both foods.

After adjusting results for possible confounding factors, such as the educational level of the mother, and total energy intake, high intakes of whole grains and fish were found to be associated with a 54 and 66% reduction in the probability of being asthmatic, respectively.

The probability of having asthma with bronchial hyperresponsiveness (BHR), defined as having an increased sensitivity to factors that cause narrowing of the airways, was reduced by 72 and 88% when children had a high-intake of whole grains and fish, respectively. Lead researcher, CoraTabak commented, "The rise in the prevalence of asthma in western societies may be related to changed dietary habits." We agree. The Standard American Diet is sorely deficient in the numerous anti-inflammatory compounds found in fish and whole grains, notably, the omega-3 fats supplied by cold water fish and the magnesium and vitamin E provided by whole grains. One caution: wheat may need to be avoided as it is a common food allergen associated with asthma.

Health-Promoting Activity Equal to or Even Higher than that of Vegetables and Fruits

Research reported at the American Institute for Cancer Research (AICR) International Conference on Food, Nutrition and Cancer, by Rui Hai Liu, M.D., Ph.D., and his colleagues at Cornell University shows that whole grains, such as oats, contain many powerful phytonutrients whose activity has gone unrecognized because research methods have overlooked them.

Despite the fact that for years researchers have been measuring the antioxidant power of a wide array of phytonutrients, they have typically measured only the "free" forms of these substances, which dissolve quickly and are immediately absorbed into the bloodstream. They have not looked at the "bound" forms, which are attached to the walls of plant cells and must be released by intestinal bacteria during digestion before they can be absorbed.

Phenolics, powerful antioxidants that work in multiple ways to prevent disease, are one major class of phytonutrients that have been widely studied. Included in this broad category are such compounds as quercetin, curcumin, ellagic acid, catechins, and many others that appear frequently in the health news.

When Dr. Liu and his colleagues measured the relative amounts of phenolics, and whether they were present in bound or free form, in common fruits and vegetables like apples, red grapes, broccoli and spinach, they found that phenolics in the "free" form averaged 76% of the total number of phenolics in these foods. In whole grains, however, "free" phenolics accounted for less than 1% of the total, while the remaining 99% were in "bound" form.

In his presentation, Dr. Liu explained that because researchers have examined whole grains with the same process used to measure antioxidants in vegetables and fruits—looking for their content of "free" phenolics"—the amount and activity of antioxidants in whole grains has been vastly underestimated.

Despite the differences in fruits', vegetables' and whole grains' content of "free" and "bound" phenolics, the total antioxidant activity in all three types of whole foods is similar, according to Dr. Liu's research. His team measured the antioxidant activity of various foods, assigning each a rating based on a formula (micromoles of vitamin C equivalent per gram). Broccoli and spinach measured 80 and 81, respectively; apple and banana measured 98 and 65; and of the whole grains tested, corn measured 181, whole wheat 77, oats 75, and brown rice 56.

Dr. Liu's findings may help explain why studies have shown that populations eating diets high in fiber-rich whole grains consistently have lower risk for colon cancer, yet short-term clinical trials that have focused on fiber alone in lowering colon cancer risk, often to the point of giving subjects isolated fiber supplements, yield inconsistent results. The explanation is most likely that these studies have not taken into account the interactive effects of all the nutrients in whole grains—not just their fiber, but also their many phytonutrients.

As far as whole grains are concerned, Dr. Liu believes that the key to their powerful cancer-fighting potential is precisely their wholeness. A grain of whole wheat consists of three parts—its endosperm (starch), bran and germ. When wheat—or any whole grain—is refined, its bran and germ are removed. Although these two parts make up only 15-17% of the grain's weight, they contain 83% of its phenolics. Dr. Liu says his recent findings on the antioxidant content of whole grains reinforce the message that a variety of foods should be eaten good health. "Different plant foods have different phytochemicals," he said. "These substances go to different organs, tissues and cells, where they perform different functions. What your body needs to ward off disease is this synergistic effect—this teamwork—that is produced by eating a wide variety of plant foods, including whole grains."

Lignans Protect against Heart Disease

One type of phytochemical especially abundant in whole grains including oats are plant lignans, which are converted by friendly flora in our intestines into mammalian lignans, including one called enterolactone that is thought to protect against breast and other hormone-dependent cancers as well as heart disease. In addition to whole grains, nuts, seeds and berries are rich sources of plant lignans, and vegetables, fruits, and beverages such as coffee, tea and wine also contain some. When blood levels of enterolactone were measured in over 800 postmenopausal women in a Danish study published in the *Journal of Nutrition*, women eating the most whole grains were found to have significantly higher blood levels of this protective lignan. Women who ate more cabbage and leafy vegetables also had higher enterolactone levels.

A Well-tolerated Wheat Alternative for Children and Adults with Celiac Disease

Although treatment of celiac disease has been thought to require lifelong avoidance of the protein gluten, which is found in wheat, rye, barley and oats, recent studies of adults have shown that oats, despite the small amount of gluten they contain, are well-tolerated. Now, a double blind, multi-center study involving 8 clinics treating 116 children newly diagnosed celiac disease suggests oats are a good grain choice for children with celiac disease as well. The children were randomly assigned to receive either the standard gluten-free diet (no wheat, barley, rye or oats) or a gluten-free diet with some wheat-free oat products. At the end of the study, which ran for a year, all the children were doing well, and in both groups, the mucosal lining of the small bowel (which is damaged by wheat gluten in celiac disease) had healed and the immune system (which is excessively reactive in celiac patients) had returned to normal.

Meta-analysis Explains Whole Grains' Health Benefits

In many studies, eating whole grains, such as oats, has been linked to protection against atherosclerosis, ischemic stroke, diabetes, insulin resistance, obesity, and premature death. A new study and accompanying editorial, published in the *American Journal of Clinical Nutrition* explains the likely reasons behind these findings and recommends at least 3 servings of whole grains should be eaten daily.

Whole grains are concentrated sources of fiber. In this meta-analysis of 7 studies including more than 150,000 persons, those whose diets provided the highest dietary fiber intake had a 29% lower risk of cardiovascular disease compared to those with the lowest fiber intake.

But it's not just fiber's ability to serve as a bulking agent that is responsible for its beneficial effects as a component of whole grains. Wheat bran, for example, which constitutes 15% of most whole-grain wheat kernels but is virtually non-existent in refined wheat flour, is rich in minerals, antioxidants, lignans, and other phytonutrients—as well as in fiber.

In addition to the matrix of nutrients in their dietary fibers, the whole-grain arsenal includes a wide variety of additional nutrients and phytonutrients that reduce the risk of cardiovascular disease. Compounds in whole grains that have cholesterol-lowering effects include polyunsaturated fatty acids, oligosaccharides, plant sterols and stanols, and saponins.

Whole grains are also important dietary sources of water-soluble, fat-soluble, and insoluble antioxidants. The long list of cereal antioxidants includes vitamin E, tocotrieonols, selenium, phenolic acids, and phytic acid. These multifunctional antioxidants come in immediate-release to slow-release forms and thus are available throughout the gastrointestinal tract over a long period after being consumed.

The high antioxidant capacity of wheat bran, for example, is 20-fold that of refined wheat flour (endosperm). Although the role of antioxidant supplements in protecting against cardiovascular disease has been questioned, prospective population studies consistently suggest that when consumed in whole foods, antioxidants are associated with significant protection against cardiovascular disease. Because free radical damage to cholesterol appears to contribute significantly to the development of atherosclerosis, the broad range of antioxidant activities from the phytonutrients abundant in whole-grains is thought to play a strong role in their cardio-protective effects.

Like soybeans, whole grains are good sources of phytoestrogens, plant compounds that may affect blood cholesterol levels, blood vessel elasticity, bone metabolism, and many other cellular metabolic processes.

Whole grains are rich sources of lignans that are converted by the human gut to enterolactone and enterodiole. In studies of Finnish men, blood levels of enterolactone have been found to have an inverse relation not just to cardiovascular-related death, but to all causes of death, which suggests that the plant lignans in whole grains may play an important role in their protective effects.

Lower insulin levels may also contribute to the protective effects of whole grains. In many persons, the risks of atherosclerotic cardiovascular disease, diabetes, and obesity are linked to insulin resistance. Higher intakes of whole grains are associated with increased sensitivity to insulin in population studies and clinical trials. Why? Because whole grains improve insulin sensitivity by lowering the glycemic index of the diet while increasing its content of fiber, magnesium, and vitamin E.

The whole kernel of truth: as part of your healthy way of eating, whole grains can significantly lower your risk of cardiovascular disease, obesity and type 2 diabetes. Enjoy at least 3 servings a day. No idea how to cook whole grains? Just look at the "How to Enjoy" section in our profiles of the whole grains, or for quick, easy, delicious recipes, click on this link to our Recipe Assistant and select oats or whichever whole grain you would like to prepare.

Description

Oats, known scientifically as *Avena sativa*, are a hearty cereal grain able to withstand poor soil conditions in which other crops are unable to thrive. Their fortitude seems to be transferred to those who consume this nutrient-rich grain. After all, when we think of a satisfying and enriching way to start the day, one that gives us strength and lasting energy, we oftentimes relish the thought of a hot bowl of oatmeal.

Oats gain part of their distinctive flavor from the roasting process that they undergo after being harvested and cleaned. Although oats are then hulled, this process does not strip away their bran and their germ allowing them to retain a concentrated source of their fiber and nutrients. Different types of processing are then used to produce the various types of oat products, which are generally used to make breakfast cereals, baked goods and stuffings:

- Oat groats: unflattened kernels that are good for using as a breakfast cereal or for stuffing
- Steel-cut oats: featuring a dense and chewy texture, they are produced by running the grain through steel blades that thinly slices them.
- Old-fashioned oats: have a flatter shape that is the result of their being steamed and then rolled.
- Quick-cooking oats: processed like old-fashioned oats, except they are cut finely before rolling
- Instant oatmeal: produced by partially cooking the grains and then rolling them very thin. Oftentimes, sugar, salt and other ingredients are added to make the finished product.
- Oat bran: the outer layer of the grain that resides under the hull. While oat bran is found in rolled oats and steel-cut oats, it may also be purchased as a separate product that can be added to recipes or cooked to make a hot cereal.
- Oat flour: used in baking, it is oftentimes combined with wheat or other gluten-containing flours when making leavened bread.

History

The modern oat draws its ancestry from the wild red oat, a plant originating in Asia. Oats have been cultivated for two thousand years in various regions throughout the world. Before being consumed as a food, oats were used for medicinal purposes, a use for which they are still honored. The growing of oats in Europe was widespread, and oats constituted an important commercial crop since they were a dietary staple for the people of many countries including Scotland, Great Britain, Germany and the Scandinavian countries. In the early 17th century, Scottish settlers brought oats to North America. Today, the largest commercial producers of oats include the Russian Federation, the United States, Germany, Poland and Finland.

How to Select and Store

Buy small quantities of oats at one time since this grain has a slightly higher fat content than other grains and will go rancid more quickly. Oats are generally available in prepackaged containers as well as bulk bins. Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the oats are covered, free from debris, and that the store has a good product turnover so as to ensure its maximal freshness. Smell the oats to make sure that they are fresh. Whether purchasing oats in bulk or in a packaged container, make sure there is no evidence of moisture.

If you purchase prepared oatmeal products such as oatmeal, look at the ingredients to ensure that the product does not contain any salt, sugar or other additives.

Store oatmeal in an airtight container in a cool, dry and dark place where they will keep for approximately two months.

How to Enjoy

A Few Quick Serving Ideas

- A great way to start your day—add your favorite nuts and fruits to a piping hot bowl of oatmeal.
- Oatmeal cookies are a favorite for kids of all ages.
- Add oat flour or whole oats the next time you make bread or muffins.
- Sprinkle oat bran on your hot or cold cereal.
- Oat groats make a great basis for stuffing for poultry.

For some of our favorite recipes, click Recipes.

Safety

Oats and the Gluten Grains

Oats are members of a non-scientifically established grain group traditionally called the "gluten grains." The idea of grouping certain grains together under the label "gluten grains" has come into question in recent years as technology has given food scientists a way to look more closely at the composition of grains. Some healthcare practitioners continue to group wheat, oats, barley and rye together under the heading of "gluten grains" and to ask for elimination of the entire group on a wheat-free diet. Other practitioners now treat wheat separately from these other grains, including oats, based on recent research. Wheat is unquestionably a more common source of food reactions than any of the other "gluten grains," including oats. Although you may initially want to eliminate oats from your meal planning if you are implementing a wheat-free diet, you will want to experiment at some point with re-introduction of this food. You may be able to take advantage of its diverse nutritional benefits without experiencing an adverse reaction. Individuals with wheat-related conditions like celiac sprue or gluten-sensitive enteropathies should consult with their healthcare practitioner before experimenting with any of the "gluten grains," including oats.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Oats, unprocessed, dry
0.25 cup
39.00 grams

Calories: 152
GI: low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
manganese	1.92 mg	96	11.4	excellent
molybdenum	28.86 mcg	64	7.6	excellent
phosphorus	203.97 mg	29	3.5	very good
copper	0.24 mg	27	3.2	good
biotin	7.80 mcg	26	3.1	good
vitamin B1	0.30 mg	25	3.0	good
magnesium	69.03 mg	17	2.0	good
fiber	4.13 g	17	2.0	good
chromium	5.38 mcg	15	1.8	good
zinc	1.55 mg	14	1.7	good
protein	6.59 g	13	1.6	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Quinoa

What's New and Beneficial About Quinoa

- The Food and Agricultural Organization of the United Nations (FAO) has officially declared that the year 2013 be recognized as "The International Year of the Quinoa." Proposed by the government of Bolivia and receiving strong support from many Central and South American countries, quinoa has now been singled out by the FAO as a food with "high nutritive value," impressive biodiversity, and an important role to play in the achievement of food security worldwide. We realize that quinoa remains unfamiliar to many people, especially in the practical sense of cooking and recipes. But we hope that situation will change, given the remarkable nature of this easily-prepared, nutrient-rich food.
- Researchers have recently taken a close look at certain antioxidant phytonutrients in quinoa, and two flavonoid—quercetin and kaempferol—are now known to be provided by quinoa in especially concentrated amounts. In fact, the concentration of these two flavonoids in quinoa can sometimes be greater than their concentration in high-flavonoid berries like cranberry or lingonberry.
- Recent studies are providing us with a greatly expanded list of anti-inflammatory phytonutrients in quinoa. This unique combination of anti-inflammatory compounds in quinoa may be the key to understanding preliminary animal studies that show decreased risk of inflammation-related problems (including obesity) when animals are fed quinoa on a daily basis. The list of anti-inflammatory phytonutrients in quinoa is now known to include: polysaccharides like arabinans and rhamnogalacturonans; hydroxycinnamic and hydroxybenzoic acids; flavonoids like quercetin and kaempferol; and saponins including molecules derived from oleanic acid, hederagenin and serjanic acid. Small amounts of the anti-inflammatory omega-3 fatty acid, alpha-linolenic acid (ALA), are also provided by quinoa.
- In comparison to cereal grasses like wheat, quinoa is higher in fat content and can provide valuable amounts of heart-healthy fats like monounsaturated fat (in the form of oleic acid). Quinoa can also provide small amounts of the omega-3 fatty acid, alpha-linolenic acid (ALA). Given this higher fat content, researchers initially assumed that quinoa would be more susceptible to oxidation and resulting nutrient damage. However, recent studies have shown that quinoa does not get oxidized as rapidly as might be expected given its higher fat content. This finding is great news from a nutritional standpoint. The processes of boiling, simmering, and steaming quinoa do not appear to significantly compromise the quality of quinoa's fatty acids, allowing us to enjoy its cooked texture and flavor while maintaining this nutrient benefit. Food scientists have speculated that it is the diverse array of antioxidants found in quinoa—including various members of the vitamin E family like alpha-, beta-, gamma- and delta-tocopherol as well as flavonoids like quercetin and kaempferol—that contribute to this oxidative protection.

Quinoa, cooked
0.75 cup
(185.00 grams)

Calories: 222
GI: low

Nutrient	DRI/DV
manganese	59%
copper	40%
phosphorus	40%
magnesium	30%
fiber	21%
folate	19%
zinc	18%

Health Benefits

Overall Nutrient Richness

Perhaps the most striking health benefit provided by quinoa is its overall nutrient richness. When the nutrient composition of this food is analyzed in depth, the results are unusual and striking. While quinoa can be eaten in the same way as a grain, or ground into flour like is so commonly done with grains, it lacks some important nutritional shortcomings of grains.

One of the shortcomings overcome by quinoa involves its protein content. Most grains are considered to be inadequate as total protein sources because they lack adequate amounts of the amino acids lysine and isoleucine. The relatively low level of both lysine and isoleucine in the protein of grains is what causes these amino acids to be considered as the limiting amino acids (LAAs) in grains. In other words, these LAAs prevent grains from serving as complete protein sources in our diet. By contrast, quinoa has significantly greater amounts of both lysine and isoleucine (especially lysine), and these greater amounts of lysine and isoleucine allow the protein in quinoa to serve as a complete protein source.

In terms of fat content, quinoa once again overcomes some of the shortcomings of most grains. Since it takes nearly 350 calories' worth of whole wheat to provide 1 gram of fat, whole wheat is not generally regarded as a significant source of fat, including essential fatty acids or heart-healthy monounsaturated fats (like oleic acid). By contrast, since it only takes 63 calories' worth of quinoa to provide 1 gram of fat, quinoa is typically considered to be a valuable source of certain health-supportive fats. About 28% of quinoa's fatty acids come in the form of oleic acid, a heart-healthy monounsaturated fat, and about 5% come in the form of alpha-linolenic acid or ALA—the omega-3 fatty acid most commonly found in plants and associated with decreased risk of inflammation-related disease.

Neither quinoa nor any grains qualify as good vitamin E sources in our WHFoods rating system. However, in the case of quinoa, or rating system does not do full justice to the fact that quinoa contains significant amounts of certain tocopherols (vitamin E family members) largely absent from most grains. For example, one cup of quinoa provides 2.2 milligrams of gamma-tocopherol—a form of vitamin E that has been more closely associated with certain anti-inflammatory benefits in health research. Quinoa is also a good source of RDA nutrients like folate, zinc, and phosphorus in contrast to whole wheat, which does not qualify as a good source in our rating system.

Quinoa is an equally impressive food in terms of its overall phytonutrient benefits. In many Central and South American countries, the leaves of the quinoa plant are valued for their betacyanin pigments, which provide some of their bright reddish shades. But even the seeds themselves can be phytonutrient-rich and can provide significant amounts of antioxidants like ferulic, coumaric, hydroxybenzoic, and vanillic acid.

The antioxidant flavonoids quercetin and kaempferol are also especially plentiful in quinoa. In fact, the concentration of these two flavonoids in quinoa can sometimes be greater than their concentration of high-flavonoid berries like cranberry or lingonberry.

Considered in combination, these diverse nutrient benefits of quinoa give it uniqueness among grain-related foods. For us, this high overall level of nourishment provided by quinoa may qualify as its greatest health benefit.

Anti-Inflammatory Benefits

Most of the quinoa studies that we've seen in this area have been animal studies. However, we believe that the preliminary indications for humans are very promising. Research has shown the ability of daily quinoa intake to lower levels of inflammation in fat (adipose) tissue in rats and in the linings of their intestine as well.

We're not surprised at either of these results because a wide range of anti-inflammatory nutrients is already known to be present in quinoa. This list of anti-inflammatory nutrients includes phenolic acids (including hydroxycinnamic and hydroxybenzoic acids), members of the vitamin E family like gamma-tocopherol, and cell wall polysaccharides like arabinans and rhamnogalacturonans.

Somewhat more controversial in this anti-inflammatory nutrient list are the saponins found in quinoa. Saponins are the bitter tasting, water-soluble phytonutrients found in the outer seed coat layer of quinoa. (More specifically, the saponins found in quinoa are derived from hederagenin, oleanic acid, phytolaccagenic acid, and serjanic acid.) The quinoa saponins have been shown to have both anti-inflammatory and antioxidant properties. However, soaking, boiling, and milling can reduce their presence, and, in general, this reduced presence is usually regarded as a good thing since it can make the quinoa much more enjoyable for most people to eat. In research to date, the relationship between and anti-inflammatory benefits of quinoa and saponin levels has yet to be clarified. However, even though more research is needed in this particular phytonutrient area, the list of anti-inflammatory nutrients in quinoa remains impressive.

Other Benefits

We have yet to see large-scale human studies on intake of quinoa and risk of type 2 diabetes or risk of cardiovascular disease. However, we would expect such studies to show significantly reduced risks. With respect to type 2 diabetes, quinoa simply has too many things in common with other foods known to decrease risk. At the top of the list here would be its fiber and protein content. Quinoa is a good source of fiber—one of the key macronutrients needed for health blood sugar regulation. It also provides outstanding protein quality, even in comparison to commonly-eaten whole grains. Strong intake of protein and fiber are two dietary essentials for regulation of blood sugar. Because chronic, unwanted inflammation is also a key risk factor for development of type 2 diabetes, the diverse range of anti-inflammatory nutrients found in quinoa also make it a great candidate for diabetes risk reduction.

Animal studies have already demonstrated the ability of quinoa to lower total cholesterol and help maintain levels of HDL cholesterol (the "good" cholesterol). While we would expect these results in humans as well, we would also expect the anti-inflammatory nutrients in quinoa to help protect human blood vessels from inflammatory damage. Protection of this kind would also provide reduced risk of many cardiovascular diseases, including atherosclerosis. We expect to see future, large-scale human studies demonstrating the benefits of quinoa for risk reduction in this area of cardiovascular disease.

The antioxidant and anti-inflammatory phytonutrients in quinoa also make it a likely candidate for cancer risk reduction in humans. Given the preliminary animal results involving the digestive tract, risk reduction for colon cancer may turn out to be a special area of interest.

A final area of likely benefit involves decreased risk of allergy—especially for individuals who have adverse reactions to certain grains and seek practical alternatives. Already, several public organizations have recommended quinoa as a substitute for wheat whenever the avoidance of this gluten-containing grain is required. The low-allergy potential of quinoa—coupled with its relatively high digestibility—has also made it a food of special interest in the diet of children and toddlers.

Description

Because quinoa is typically consumed in the same way as the cereal grasses (wheat, oats, barley, and rye), we group it together with those foods on our website. However, quinoa is not a cereal grass at all, but rather a member of the same food family that contains spinach, Swiss chard, and beets. Many researchers refer to quinoa as a "pseudocereal." This term is typically used to describe foods that are not grasses but can still be easily ground into flour. The scientific name for quinoa is *Chenopodium quinoa*.

Researchers date the popularity of quinoa to approximately 3000 BC, when its consumption became widespread in the Andes mountains regions of South America. About 250 different varieties of quinoa were already present at that time, giving quinoa a remarkable tolerance for different growing conditions. Quinoa is able to survive high altitudes, thin and cold air, hot sun, salty or sandy soil, little rainfall, and sub-freezing temperatures. In addition, all parts of the plant could be eaten, including not only the seeds that we buy in the store and that may also have been dried and ground into flour, but also the leaves and stems. Betacyanin pigments presemt in some quinoa leaves given them their bright reddish color, but it's also possible to find orange, pink, purple, tan, and black quinoa as well. Quinoa leaves taste similar in flavor to the leaves of their fellow chenopods, namely, spinach, chard, and beets. Cooked quinoa seeds are fluffy and creamy, yet also slightly crunchy. They may also sometimes have an amazing translucent appearance. The flavor of the cooked seeds is delicate and somewhat nutty.

The word "quinoa" is pronounced "KEEN-wah." It comes from the Spanish word, *quinua*, which itself comes from the word "kinwa" or "kinua" in the Quechua dialect.

History

The history of quinoa is clearly rooted in South America, in the Andes region that is currently divided up between the countries of Argentina, Bolivia, Chile, Colombia, Ecuador, and Peru. Along with maize, quinoa was one of the two mainstay foods for the Inca Empire that had its start around 1200 AD. As previously mentioned in the Description section, quinoa was a food that could survive in a wide variety of growing conditions. Along with its unusual nutrient richness, its adaptability helped it gain popularity among the Incas for hundreds and hundreds of years.

Most quinoa consumed in the United States still comes from South America. Peru remains the largest commercial producer of quinoa, harvesting 41,079 metric tons in 2010. Bolivia was the second largest producer with 29,500 metric tons. Together, these two South American countries produced nearly 99% of all commercially grown quinoa in 2010. In terms of export sales, quinoa has risen to the level of an $87 million dollar business in these two countries.

Some commercial quinoa production takes place in the United States, although total cultivation remains under 10,000 pounds. The Colorado Rockies have been a place of special interest for quinoa production, and some production has also occurred in the states of California, Washington, and Oregon.

Interest in quinoa has recently spread to India (including the North-India Plains and high-altitude areas of the Himalayas), other parts of Asia (including Japan), as well as to Africa and part of Europe. Designation of the year 2013 as "The International Year of the Quinoa" by the Food and Agricultural Organization of the United Nations (FAO) may also trigger greater attention to this food worldwide.

How to Select and Store

Quinoa is generally available in prepackaged containers as well as bulk bins. Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the quinoa are covered and that the store has a good product turnover so as to ensure its maximal freshness. Whether purchasing quinoa in bulk or in a packaged container, make sure that there is no evidence of moisture. When deciding upon the amount to purchase, remember that quinoa expands during the cooking process to several times its original size. If you cannot find it in your local supermarket, look for it at natural foods stores, which usually carry it.

The most common type of quinoa you will find in the store has an off-white color but red and black quinoa are becoming more available. You may even be able to find a tri-color mixture sold in packages or bulk bins.

Store quinoa in an airtight container. It will keep for a longer period of time, approximately three to six months, if stored in the refrigerator.

How to Enjoy

- Combine cooked chilled quinoa with pinto beans, pumpkin seeds, scallions and coriander. Season to taste and enjoy this south-of-the-border inspired salad.
- Add nuts and fruits to cooked quinoa and serve as breakfast porridge.
- For a twist on your favorite pasta recipe, use noodles made from quinoa.
- Sprouted quinoa can be used in salads and sandwiches just like alfalfa sprouts.
- Add quinoa to your favorite vegetable soups.
- Ground quinoa flour can be added to cookie or muffin recipes.
- Quinoa is great to use in tabouli, serving as a delicious (and wheat-free) substitute for the bulgar wheat with which this Middle Eastern dish is usually made.

For some of our favorite recipes, click Recipes.

Safety

Quinoa is not a commonly allergenic food. Because quinoa does not belong to the plant family containing wheat, oats, barley, and rye, it is also a gluten-free food. Some studies also show a higher-than-expected digestibility for quinoa, making it a food less likely to produce adverse reactions.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Quinoa, cooked **0.75 cup** **185.00 grams**				**Calories: 222** **GI: low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
manganese	1.17 mg	59	4.7	very good
phosphorus	281.20 mg	40	3.3	good
copper	0.36 mg	40	3.2	good
magnesium	118.40 mg	30	2.4	good
fiber	5.18 g	21	1.7	good
folate	77.70 mcg	19	1.6	good
zinc	2.02 mg	18	1.5	good

World's Healthiest	

Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Rye

Although wheat products reign supreme on the shelves of supermarkets in the United States, foods made from whole rye are worth looking for, not only for their rich, hearty taste, but for their numerous health benefits. Like most grains, rye is available throughout the year.

Rye is a cereal grain that looks like wheat but is longer and more slender and varies in color from yellowish brown to grayish green. It is generally available in its whole or cracked grain form or as flour or flakes that look similar to old-fashioned oats. Because it is difficult to separate the germ and bran from the endosperm of rye, rye flour usually retains a large quantity of nutrients, in contrast to refined wheat flour.

Rye, whole grain, dry
0.33 cup
(55.77 grams)

Calories: 189
GI: low

Nutrient	DRI/DV
manganese	72%
fiber	34%
phosphorus	26%
copper	22%
pantothenic acid	16%
magnesium	15%

Health Benefits

In the U.S., where wheat products are the norm, goods made from rye are rarely given premier shelf space on grocery store shelves and, out of sight, remain out of mind. But foods made from whole rye are worth looking for, not only for their rich, hearty taste, but for the numerous health benefits they supply.

Rye's Fiber Promotes Weight Loss

Rye is a good source of fiber, which is especially important in the United States, since most Americans do not get enough fiber in their diets. Rye fiber is richly endowed with noncellulose polysaccharides, which have exceptionally high water-binding capacity and quickly give a feeling a fullness and satiety, making rye bread a real help for anyone trying to lose weight.

And Helps Prevent Gallstones

Eating foods high in insoluble fiber, such as rye, can help women avoid gallstones, shows a study published in the *American Journal of Gastroenterology*.

Studying the overall fiber intake and types of fiber consumed over a 16 year period by over 69,000 women in the Nurses Health Study, researchers found that those consuming the most fiber overall (both soluble and insoluble) had a 13% lower risk of developing gallstones compared to women consuming the fewest fiber-rich foods.

Those eating the most foods rich in insoluble fiber gained even more protection against gallstones: a 17% lower risk compared to women eating the least. And the protection was dose-related; a 5-gram increase in insoluble fiber intake dropped risk dropped 10%.

How do foods rich in insoluble fiber help prevent gallstones? Researchers think insoluble fiber not only speeds intestinal transit time (how quickly food moves through the intestines), but reduces the secretion of bile acids (excessive amounts contribute to gallstone formation), increases insulin sensitivity and lowers triglycerides (blood fats). Abundant in all whole grains, insoluble fiber is also found in nuts and the edible skin of fruits and vegetables including tomatoes, cucumbers, many squash, apples, berries, and pears. In addition, beans provide insoluble as well as soluble fiber.

Rye and Other Whole Grains Substantially Lower Type 2 Diabetes Risk

Rye and other whole grains are a rich source of magnesium, a mineral that acts as a co-factor for more than 300 enzymes, including enzymes involved in the body's use of glucose and insulin secretion.

The FDA permits foods that contain at least 51% whole grains by weight (and are also low in fat, saturated fat, and cholesterol) to display a health claim stating consumption is linked to lower risk of heart disease and certain cancers. Now, research suggests regular consumption of whole grains also reduces risk of type 2 diabetes. (van Dam RM, Hu FB, *Diabetes Care*).

In this 8-year trial, involving 41,186 particpants of the Black Women's Health Study, research data confirmed inverse associations between magnesium, calcium and major food sources in relation to type 2 diabetes that had already been reported in predominantly white populations.

Risk of type 2 diabetes was 31% lower in black women who frequently ate whole grains compared to those eating the least of these magnesium-rich foods. When the women's dietary intake of magnesium intake was considered by itself, a beneficial, but lesser—19%—reduction in risk of type 2 diabetes was found, indicating that whole grains offer special benefits in promoting healthy blood sugar control. Daily consumption of low-fat dairy foods was also helpful, lowering risk of type 2 diabetes by 13%. Get the benefits of both rye and dairy by enjoying a hot breakfast porridge made using rolled rye—instead of oat—flakes topped with low-fat milk.

A Better Grain Choice for Persons with Diabetes

Rye bread may be a better choice than wheat bread for persons with diabetes. A study published in the *American Journal of Clinical Nutrition* found that bread made from wheat triggers a greater insulin response than rye bread does. Finnish researchers at the University of Kupio compared the effects of eating refined wheat bread with endosperm rye bread, traditional rye bread and high fiber rye bread on several markers of blood sugar control including plasma glucose, insulin, glucose-dependent insulinotropic polypeptide (GIP), glucagon-like peptide 1 (GLP1), and serum C-peptide in 19 healthy post-menopausal women. (GIP and GLP1 are hormones secreted within the gastrointestinal tract during meals that boost the effects of insulin; c-peptide is a marker of insulin secretion.) All of these markers were evaluated in blood samples taken both before and after the women ate each of the breads. Results showed that after the women had eaten any of the rye breads, their insulin, GIP and C-peptide responses were significantly lower than after they ate wheat bread. Among the different rye breads, however, no significant differences were seen in insulin and C-peptide response despite their varying levels of fiber. Researchers felt this lower after-meal insulin response could, therefore, not be attributed only to the fiber content of the rye breads, but was also due to the fact that the starch granules in rye bread form a less porous and mechanically firmer matrix than in wheat bread. This would translate into a much greater particle size being swallowed when rye bread is eaten compared to wheat, which would slow the rate at which the starch could be digested into sugar.

Fiber Fights Diabetes and Cardiovascular Disease and Promotes Gastrointestinal Health

In addition to its usefulness in weight reduction, fiber, like that found in rye, has been shown to be useful for a number of different conditions. One of the most important properties of fiber is its ability to bind to toxins in the colon and then remove them from the body. When it binds to cancer-causing chemicals, fiber helps protect the cells of the colon from damage. This is one reason why a high-fiber diet has been shown to prevent colon cancer. When fiber binds to bile salts in the intestines and removes them from the body, the body is forced to make more bile salts. This is good, because the body must break down cholesterol to make bile. This explains why a good intake of fiber can help to lower high cholesterol levels.

Due to their high-fiber content, whole rye foods can help to prevent high blood sugar levels in diabetic patients, thereby helping with blood sugar control.

Significant Cardiovascular Benefits for Postmenopausal Women

Eating a serving of whole grains, such as rye, at least 6 times each week is an especially good idea for postmenopausal women with high cholesterol, high blood pressure or other signs of cardiovascular disease (CVD).

A 3-year prospective study of over 200 postmenopausal women with CVD, published in the *American Heart Journal*, shows that those eating at least 6 servings of whole grains each week experienced both:

- Slowed progression of atherosclerosis, the build-up of plaque that narrows the vessels through which blood flows, and
- Less progression in stenosis, the narrowing of the diameter of arterial passageways.

The women's intake of fiber from fruits, vegetables and refined grains was *not* associated with a lessening in CVD progression.

Prevent Heart Failure with a Whole Grains Breakfast

Heart failure is the leading cause of hospitalization among the elderly in the United States. Success of drug treatment is only partial (ACE inhibitors and beta-blockers are typically used; no evidence has found statins safe or effective for heart failure), and its prognosis remains poor. Follow up of 2445 discharged hospital patients with heart failure revealed that 37.3% died during the first year, and 78.5% died within 5 years.

Since consumption of whole grain products and dietary fiber has been shown to reduce the risk of high blood pressure and heart attack, Harvard researchers decided to look at the effects of cereal consumption on heart failure risk and followed 21,376 participants in the Physicians Health Study over a period of 19.6 years.

After adjusting for confounding factors (age, smoking, alcohol consumption, vegetable consumption, use of vitamins, exercise, and history of heart disease), they found that men who simply enjoyed a daily morning bowl of whole grain (but not refined) cereal had a 29% lower risk of heart failure. Isn't your heart worth protecting, especially when the prescription—a morning bowl of hearty whole grains—is so delicious? For quick, easy, heart-healthy, whole grain recipes, click The World's Healthiest Foods, and look at the "How to Enjoy" section in any of our grain profiles.

Anti-Cancer Activity Equal to or Even Higher than that of Vegetables and Fruits

Research reported at the American Institute for Cancer Research (AICR) International Conference on Food, Nutrition and Cancer, by Rui Hai Liu, M.D., Ph.D., and his colleagues at Cornell University shows that whole grains, such as rye, contain many powerful phytonutrients whose activity has gone unrecognized because research methods have overlooked them.

Despite the fact that for years researchers have been measuring the antioxidant power of a wide array of phytonutrients, they have typically measured only the "free" forms of these substances, which dissolve quickly and are immediately absorbed into the bloodstream. They have not looked at the "bound" forms, which are attached to the walls of plant cells and must be released by intestinal bacteria during digestion before they can be absorbed.

Phenolics, powerful antioxidants that work in multiple ways to prevent disease, are one major class of phytonutrients that have been widely studied. Included in this broad category are such compounds as quercetin, curcumin, ellagic acid, catechins, and many others that appear frequently in the health news.

When Dr. Liu and his colleagues measured the relative amounts of phenolics, and whether they were present in bound or free form, in common fruits and vegetables like apples, red grapes, broccoli and spinach, they found that phenolics in the "free" form averaged 76% of the total number of phenolics in these foods. In whole grains, however, "free" phenolics accounted for less than 1% of the total, while the remaining 99% were in "bound" form.

In his presentation, Dr. Liu explained that because researchers have examined whole grains with the same process used to measure antioxidants in vegetables and fruits—looking for their content of "free" phenolics"—the amount and activity of antioxidants in whole grains has been vastly underestimated.

Despite the differences in fruits', vegetables' and whole grains' content of "free" and "bound" phenolics, the total antioxidant activity in all three types of whole foods is similar, according to Dr. Liu's research. His team measured the antioxidant activity of various foods, assigning each a rating based on a formula (micromoles of vitamin C equivalent per gram). Broccoli and spinach measured 80 and 81, respectively; apple and banana measured 98 and 65; and of the whole grains tested, corn measured 181, whole wheat 77, oats 75, and brown rice 56.

Dr. Liu's findings may help explain why studies have shown that populations eating diets high in fiber-rich whole grains consistently have lower risk for colon cancer, yet short-term clinical trials that have focused on fiber alone in lowering colon cancer risk, often to the point of giving subjects isolated fiber supplements, yield inconsistent results. The explanation is most likely that these studies have not taken into account the interactive effects of all the nutrients in whole grains—not just their fiber, but also their many phytonutrients. As far as whole grains are concerned, Dr. Liu believes that the key to their powerful cancer-fighting potential is precisely their wholeness. A grain of whole wheat consists of three parts—its endosperm (starch), bran and germ. When wheat—or any whole grain—is refined, its bran and germ are removed. Although these two parts make up only 15-17% of the grain's weight, they contain 83% of its phenolics. Dr. Liu says his recent findings on the antioxidant content of whole grains reinforce the message that a variety of foods should be eaten good health. "Different plant foods have different phytochemicals," he said. "These substances go to different organs, tissues and cells, where they perform different functions. What your body needs to ward off disease is this synergistic effect—this teamwork—that is produced by eating a wide variety of plant foods, including whole grains."

Lignans Protect against Heart Disease

One type of phytonutrient especially abundant in whole grains such as rye are plant lignans, which are converted by friendly flora in our intestines into mammalian lignans, including one called enterolactone that is thought to protect against breast and other hormone-dependent cancers as well as heart disease. In addition to whole grains, nuts, seeds and berries are rich sources of plant lignans, and vegetables, fruits, and beverages such as coffee, tea and wine also contain some. When blood levels of enterolactone were measured in over 800 postmenopausal women in a Danish study published in the *Journal of Nutrition*, women eating the most whole grains were found to have significantly higher blood levels of this protective lignan. Women who ate more cabbage and leafy vegetables also had higher enterolactone levels.

Rye Can Ease Your Ride Through Menopause While Helping Prevent Breast Cancer

Another situation in which rye may be helpful is menopause. Rye contains a type of *lignan* that has *phytoestrogenic* activity. In the body, phytoestrogens act a little like natural estrogens, and although their effect is much much weaker, they can help normalize estrogenic activity. For some women, the phytoestrogens in rye are just strong enough to help prevent or reduce uncomfortable symptoms that may accompany menopause, like hot flashes, which are thought to be due to plummeting estrogen levels. On the other hand, when too much estrogen is around, rye's lignans, by occupying estrogen receptors, block out the much more powerful human estrogens, causing a lowering in estrogenic activity, and providing potential protection against breast cancer.

Fiber from Whole Grains and Fruit Protective against Breast Cancer

When researchers looked at how much fiber 35,972 participants in the UK Women's Cohort Study ate, they found a diet rich in fiber from whole grains, such as rye, and fruit offered significant protection against breast cancer for pre-menopausal women. (Cade JE, Burley VJ, et al., *International Journal of Epidemiology*).

Pre-menopausal women eating the most fiber (>30 grams daily) more than halved their risk of developing breast cancer, enjoying a 52% lower risk of breast cancer compared to women whose diets supplied the least fiber (<20 grams/day).

Fiber supplied by whole grains offered the most protection. Pre-menopausal women eating the most whole grain fiber (at least 13 g/day) had a 41% reduced risk of breast cancer, compared to those with the lowest whole grain fiber intake (4 g or less per day).

Fiber from fruit was also protective. Pre-menopausal women whose diets supplied the most fiber from fruit (at least 6 g/day) had a 29% reduced risk of breast cancer, compared to those with the lowest fruit fiber intake (2 g or less per day).

Practical Tip: As the following table shows, it's surprisingly easy to enjoy a healthy way of eating that delivers at least 13 grams of whole grain fiber and 6 grams of fiber from fruit each day.

Food	Fiber Content in Grams
Oatmeal, 1 cup	3.98
Whole wheat bread, 1 slice	2
Whole wheat spaghetti, 1 cup	6.3
Brown rice, 1 cup	3.5
Barley, 1 cup	13.6
Buckwheat, 1 cup	4.54
Rye, 1/3 cup	8.22
Corn, 1 cup	4.6
Apple, 1 medium with skin	5.0
Banana, 1 medium	4.0
Blueberries, 1 cup	3.92
Orange, 1 large	4.42
Pear, 1 large	5.02
Prunes, 1/4 cup	3.02
Strawberries, 1 cup	3.82

Raspberries, 1 cup	8.36

*Fiber content can vary between brands. Source: esha Research, Food Processor for Windows, Version 7.8

Cereal and Fruit Fiber Protective against Postmenopausal Breast Cancer

Results of a prospective study involving 51,823 postmenopausal women for an average of 8.3 years showed a 34% reduction in breast cancer risk for those consuming the most fruit fiber compared to those consuming the least. In addition, in the subgroup of women who had ever used hormone replacement, those consuming the most fiber, especially cereal fiber, had a 50% reduction in their risk of breast cancer compared to those consuming the least. Int J Cancer. 2008 Jan 15;122(2):403-12.

Fruits richest in fiber include apples, dates, figs, pears and prunes. When choosing a high fiber cereal, look for whole grain cereals as they supply the most bran (a mere 1/3rd cup of bran contains about 14 grams of fiber). Rye is exceptionally high in fiber. One-third cup of rye provides more than one-third of your RDI for fiber. Try cooked rye flakes or cooked rye berries as an alternative to hot oatmeal for breakfast or enjoy the rich, hearty taste of rye bread with your soup or as the bread for your sandwich.

Whole Grains and Fish Highly Protective against Childhood Asthma

According to the American Lung Association, almost 20 million Americans suffer from asthma, which is reported to be responsible for over 14 million lost school days in children, and an annual economic cost of more than $16.1 billion.

Increasing consumption of whole grains and fish could reduce the risk of childhood asthma by about 50%, suggests the International Study on Allergy and Asthma in Childhood (Tabak C, Wijga AH, *Thorax*).

The researchers, from the Dutch National Institute of Public Health and the Environment, Utrecht University, University Medical Center Groningen, used food frequency questionnaires completed by the parents of 598 Dutch children aged 8-13 years. They assessed the children's consumption of a range of foods including fish, fruits, vegetables, dairy and whole grain products. Data on asthma and wheezing were also assessed using medical tests as well as questionnaires.

While no association between asthma and intake of fruits, vegetables, and dairy products was found (a result at odds with other studies that have supported a link between antioxidant intake, particularly vitamins C and E, and asthma), the children's intake of both whole grains and fish was significantly linked to incidence of wheezing and current asthma.

In children with a low intake of fish and whole grains, the prevalence of wheezing was almost 20%, but was only 4.2% in children with a high intake of both foods. Low intake of fish and whole grains also correlated with a much higher incidence of current asthma (16.7%). compared to only a 2.8% incidence of current asthma among children with a high intake of both foods.

After adjusting results for possible confounding factors, such as the educational level of the mother, and total energy intake, high intakes of whole grains and fish were found to be associated with a 54 and 66% reduction in the probability of being asthmatic, respectively.

The probability of having asthma with bronchial hyperresponsiveness (BHR), defined as having an increased sensitivity to factors that cause narrowing of the airways, was reduced by 72 and 88% when children had a high-intake of whole grains and fish, respectively. Lead researcher, CoraTabak commented, "The rise in the prevalence of asthma in western societies may be related to changed dietary habits." We agree. The Standard American Diet is sorely deficient in the numerous anti-inflammatory compounds found in fish and whole grains, notably, the omega-3 fats supplied by cold water fish and the magnesium and vitamin E provided by whole grains. One caution: wheat may need to be avoided as it is a common food allergen associated with asthma.

Meta-analysis Explains Whole Grains' Health Benefits

In many studies, eating whole grains, such as rye, has been linked to protection against atherosclerosis, ischemic stroke, diabetes, insulin resistance, obesity, and premature death. A new study and accompanying editorial, published in the American Journal of Clinical Nutrition explains the likely reasons behind these findings and recommends at least 3 servings of whole grains should be eaten daily.

Whole grains are concentrated sources of fiber. In this meta-analysis of 7 studies including more than 150,000 persons, those whose diets provided the highest dietary fiber intake had a 29% lower risk of cardiovascular disease compared to those with the lowest fiber intake.

But it's not just fiber's ability to serve as a bulking agent that is responsible for its beneficial effects as a component of whole grains. Wheat bran, for example, which constitutes 15% of most whole-grain wheat kernels but is virtually non-existent in refined wheat flour, is rich in minerals, antioxidants, lignans, and other phytonutrients'as well as in fiber.

In addition to the matrix of nutrients in their dietary fibers, the whole-grain arsenal includes a wide variety of additional nutrients and phytonutrients that reduce the risk of cardiovascular disease. Compounds in whole grains that have cholesterol-lowering effects include polyunsaturated fatty acids, oligosaccharides, plant sterols and stanols, and saponins.

Whole grains are also important dietary sources of water-soluble, fat-soluble, and insoluble antioxidants. The long list of cereal antioxidants includes vitamin E, tocotrieonols, selenium, phenolic acids, and phytic acid. These multifunctional antioxidants come in immediate-release to slow-release forms and thus are available throughout the gastrointestinal tract over a long period after being consumed.

The high antioxidant capacity of wheat bran is 20-fold that of refined wheat flour (endosperm). Although the role of antioxidant supplements in protecting against cardiovascular disease has been questioned, prospective population studies consistently suggest that when consumed in whole foods, antioxidants are associated with significant protection against cardiovascular disease. Because free radical damage to cholesterol appears to contribute significantly to the development of atherosclerosis, the broad range of antioxidant activities from the phytonutrients abundant in whole-grains is thought to play a strong role in their cardio-protective effects.

Like soybeans, whole grains are good sources of phytoestrogens, plant compounds that may affect blood cholesterol levels, blood vessel elasticity, bone metabolism, and many other cellular metabolic processes.

Whole grains are rich sources of lignans that are converted by the human gut to enterolactone and enterodiole. In studies of Finnish men, blood levels of enterolactone have been found to have an inverse relation not just to cardiovascular-related death, but to all causes of death, which suggests that the plant lignans in whole grains may play an important role in their protective effects.

Lower insulin levels may also contribute to the protective effects of whole grains. In many persons, the risks of atherosclerotic cardiovascular disease, diabetes, and obesity are linked to insulin resistance. Higher intakes of whole grains are associated with increased sensitivity to insulin in population studies and clinical trials. Why? Because whole grains improve insulin sensitivity by lowering the glycemic index of the diet while increasing its content of fiber, magnesium, and vitamin E.

The whole kernel of truth: as part of your healthy way of eating, whole grains can significantly lower your risk of cardiovascular disease, obesity and type 2 diabetes. Enjoy at least 3 servings a day. No idea how to cook whole grains? Just look at the "How to Enjoy" section in our profiles of the whole grains, or for quick, easy, delicious recipes, click on this link to our Recipe Assistant and select whichever whole grain you would like to prepare.

Description

Rye is a cereal grain, known scientifically as *Secale cereale*, which looks like wheat but is longer and more slender. Rye's color varies from yellowish brown to grayish green. It is generally available in its whole or cracked grain form or as flour or flakes, the latter of which looks similar to old-fashioned oats. Rye has a very hardy, deep, nourishing taste.

Rye is the key ingredient in traditional rye and pumpernickel breads. Since its gluten is less elastic than wheat's, and it holds less gas during the leavening process, breads made with rye flour are more compact and dense. Since it is difficult to separate the germ and bran from the endosperm of rye, rye flour usually retains a large quantity of nutrients, unlike refined wheat flour.

History

Rye is one of the most recently domesticated cereal crops. Unlike some other cereal grains that can be traced back to prehistoric times, rye was not cultivated until around 400 B.C. It was first grown in this manner in Germany. Rye is thought to have originated from a wild species that grew as weeds among wheat and barley fields.

Unfortunately, ever since the times of the ancient Greeks and Romans, this nutrient-rich grain has not been widely enjoyed. In many countries, rye seems to have been relegated to a food for the poor, and as standards of living rose in varied civilizations, the consumption of rye declined. Yet, in some food cultures, such as those of Scandinavian and Eastern European countries, rye retains a very important position. Hopefully, as more and more people discover rye's nutritional benefits and its unique taste profile, it will assume a more important role in our diets.

Today, the majority of the world's rye comes from the Russian Federation. Poland, China, Canada, and Denmark are among the other countries that also grow rye commercially.

How to Select and Store

Rye is generally available prepackaged as well as in bulk containers. Just as with any other food that you may purchase in the bulk section, make sure that the bins containing the rye are covered and that the store has a good product turnover so as to ensure its maximal freshness. Whether purchasing rye in bulk or in a packaged container, make sure that there is no evidence of moisture.

When shopping for rye bread, make sure to read the labels since sometimes what is labeled "rye bread" is often wheat bread colored with caramel coloring.

Store rye in an airtight container in a cool, dry and dark place where it will keep for several months.

How to Enjoy

A Few Quick Serving Ideas

- For a hot breakfast alternative to oatmeal, make a porridge using rolled rye flakes.
- Cooked rye berries can be served as a side dish alternative to rice with a variety of different meals.
- For a change of pace, make your favorite sandwiches on rye bread instead of wheat bread.
- Substitute some rye flour for wheat flour in your favorite pancake, muffin and bread recipes.

For some of our favorite recipes, click Recipes.

Safety

Rye and the Gluten Grains

Rye is a member of a non-scientifically established grain group traditionally called the "gluten grains." The idea of grouping certain grains together under the label "gluten grains" has come into question in recent years as technology has given food scientists a way to look more closely at the composition of grains. Some healthcare practitioners continue to group wheat, oats, barley and rye together under the heading of "gluten grains" and to ask for elimination of the entire group on a wheat-free diet. Other practitioners now treat wheat separately from these other grains, including rye, based on recent research. Wheat is unquestionably a more common source of food reactions than any of the other "gluten grains," including rye. Although you may initially want to eliminate rye from your meal planning if you are implementing a wheat-free diet, you will want to experiment at some point with re-introduction of this food. You may be able to take advantage of its diverse nutritional benefits without experiencing an adverse reaction. Individuals with wheat-related conditions like celiac sprue or gluten-sensitive enteropathies should consult with their healthcare practitioner before experimenting with any of the "gluten grains," including rye.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Rye, whole grain, dry **0.33 cup** **55.77 grams**				**Calories: 189** **GI: low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
manganese	1.44 mg	72	6.9	very good
fiber	8.42 g	34	3.2	good
phosphorus	185.16 mg	26	2.5	good
copper	0.20 mg	22	2.1	good
pantothenic acid	0.81 mg	16	1.5	good
magnesium	61.35 mg	15	1.5	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Whole wheat

Wheat, bulgar, cooked
1.00 cup
(182.00 grams)

Calories: 151
GI: low

Nutrient	DRI/DV
manganese	56%
fiber	33%
copper	16%
magnesium	15%
pantothenic acid	13%

Health Benefits

Wheat—The Whole Truth

The health benefits of wheat depend entirely on the form in which you eat it. These benefits will be few if you select wheat that has been processed into 60% extraction, bleached white flour. 60% extraction—the standard for most wheat products in the United States, including breads, noodles and pastas, baked goods like rolls or biscuits, and cookies—means that 40% of the original wheat grain was removed, and only 60% is left. Unfortunately, the 40% that gets removed includes the bran and the germ of the wheat grain—its most nutrient-rich parts. In the process of making 60% extraction flour, over half of the vitamin B1, B2, B3, E, folic acid, calcium, phosphorus, zinc, copper, iron, and fiber are lost.

Since 1941, laws in the United States have required "enrichment" of processed wheat flour with vitamins B1, B2, B3 and iron in response to the problems created by 60% extraction. Since not nearly as much of these B vitamins and iron are replaced as are removed from 60% extraction flour, "enriched" seems an odd word to describe this process.

If you select 100% whole wheat products, however, the bran and the germ of the wheat will remain in your meals, and the health benefits will be impressive! Our food ranking qualified whole wheat (in its original non-enriched form) as a very good source of dietary fiber and manganese, and as a good source of magnesium.

The many benefits of whole wheat products are being recognized more and more by consumers. Even though many health-conscious individuals have been cutting back on their intake of total carbs and refined wheat products (by about 10% between 1997-2007), the demand for whole wheat products has actually increased during that same time period. This trend fits in well with a Mediterranean diet approach to health, which looks to lower overall carbs but higher whole grains, including whole wheat.

Women Who Eat Whole Grains Weigh Less

A study published in the *American Journal of Clinical Nutrition* underscores the importance of choosing whole rather than refined wheat to maintain a healthy body weight. In this Harvard Medical School / Brigham and Women's Hospital study, which collected data on over 74,000 female nurses aged 38-63 years over a 12 year period, weight gain was inversely associated with the intake of high-fiber, whole-grain foods, such as whole wheat, but positively related to the intake of refined-grain foods, such as products made from refined wheat. Not only did women who consumed more whole grains consistently weigh less than those who ate less of these fiber-rich foods, but those consuming the most dietary fiber from whole grains were 49% less likely to gain weight compared to those eating foods made from refined grains.

Whole Grains Reduce Risk of Metabolic Syndrome

First we were told, "Don't eat fat, and you'll stay trim." After following this advice only to see obesity expand to never before seen proportions, we're told by the food gurus, "Eating fat is fine. Shun carbohydrates to stay slim."

In our opinion, neither piece of dietary advice is complete, accurate or likely to help us stay slim or healthy. Just as different kinds of fats have different effects in our bodies (e.g., saturated and trans fats are linked to increased risk for cardiovascular disease while omega-3 fats decrease cardiovascular disease risk), some carbohydrates, such as whole grains, are healthful while others, such as refined grains and the foods made from them, are not.

The latest research is clearly supporting this vital distinction. Refined grains and the foods made from them (e.g., white breads, cookies, pastries, pasta and rice) are now being linked not only to weight gain but to increased risk of insulin resistance (the precursor of type 2 diabetes) and the metabolic syndrome (a strong predictor of both type 2 diabetes and cardiovascular disease), while eating more wholegrain foods is being shown to protect against all these ills. Common features of the metabolic syndrome include visceral obesity (the "apple shaped" body), low levels of protective HDL cholesterol, high triglycerides, and high blood pressure.

In one of the most recent studies, which appeared in *Diabetes Care*, researchers who analyzed data on over 2,800 participants in the Framingham Offspring Study, found that the prevalence of both insulin resistance and the metabolic syndrome was significantly lower among those eating the most cereal fiber from whole grains compared to those eating the least.

Prevalence of the metabolic syndrome was 38% lower among those with the highest intake of fiber from whole grains. Conversely, study subjects whose diets had the highest glycemic index and glycemic load, both of which are typically low in whole foods and high in processed refined foods, were 141% more likely to have the metabolic syndrome compared to those whose diets had the lowest glycemic index and glycemic load. In other words, compared to those whose diets were primarily composed of whole high fiber foods: whole grains, legumes, vegetables and fruits.

The researchers concluded, "Given that both a high cereal fiber content and lower glycemic index are attributes of wholegrain foods, recommendation to increase wholegrain intake may reduce the risk of developing the metabolic syndrome." Our perspective at the World's Healthiest Foods is that a way of eating that relies on the healthiest foods from all the food groups—the whole foods that contain the healthiest fats, carbohydrates and proteins—is the most effective, intelligent, and most enjoyable way to not only lower your risk of developing the metabolic syndrome, but to stay slim, vital and attractive throughout a long and healthy life.

Whole Grains Substantially Lower Type 2 Diabetes Risk

Whole grains are a rich source of magnesium, a mineral that acts as a co-factor for more than 300 enzymes, including enzymes involved in the body's use of glucose and insulin secretion.

The FDA permits foods that contain at least 51% whole grains by weight (and are also low in fat, saturated fat, and cholesterol) to display a health claim stating consumption is linked to lower risk of heart disease and certain cancers. Now, research suggests regular consumption of whole grains also reduces risk of type 2 diabetes. (van Dam RM, Hu FB, *Diabetes Care*).

In this 8-year trial, involving 41,186 particpants of the Black Women's Health Study, research data confirmed inverse associations between magnesium, calcium and major food sources in relation to type 2 diabetes that had already been reported in predominantly white populations.

Risk of type 2 diabetes was 31% lower in black women who frequently ate whole grains compared to those eating the least of these magnesium-rich foods. When the women's dietary intake of magnesium intake was considered by itself, a beneficial, but lesser-19%-reduction in risk of type 2 diabetes was found, indicating that whole grains offer special benefits in promoting healthy blood sugar control. Daily consumption of low-fat dairy foods was also helpful, lowering risk of type 2 diabetes by 13%.

Whole Wheat's Betaine Lessens Chronic Inflammation

People whose diets supplied the highest average intake of choline (found in egg yolk and soybeans), and its metabolite betaine (found naturally in beets, spinach and whole wheat), have levels of inflammatory markers at least 20% lower than subjects with the lowest average intakes, report Greek researchers in the *American Journal of Clinical Nutrition* (Detopoulou P, Panagiotakos DB, et al.)

Compared to those whose diets contained <250 mg/day of choline, subjects whose diets supplied >310 mg of choline daily had, on average:

- 22% lower concentrations of C-reactive protein
- 26% lower concentrations of interleukin-6
- 6% lower concentrations of tumor necrosis factor alpha

Compared to those consuming <260 mg/day of betaine, subjects whose diets provided >360 mg per day of betaine had, on average:

- 10% lower concentrations of homocysteine

- 19% lower concentrations of C-reactive protein
- 12% lower concentrations of tumor necrosis factor alpha

Each of these markers of chronic inflammation has been linked to a wide range of conditions including heart disease, osteoporosis, cognitive decline and Alzheimer's, and type-2 diabetes.

In an accompanying editorial in the *American Journal of Clinical Nutrition* entitled, "Is there a new component of the Mediterranean diet that reduces inflammation?," Steven Zeisel from the University of North Carolina at Chapel Hill noted that choline and betaine work together in the cellular process of methylation, which is not only responsible for the removal of homocysteine, but is involved in turning off the promoter regions of genes involved in inflammation.

"Exposure to oxidative stress is a potent trigger for inflammation. Betaine is formed from choline within the mitochondria , and this oxidation contributes to mitochondrial redox status ," Zeisel continued.

"If the association between choline and betaine and inflammation can be confirmed in studies of other populations, an interesting new dietary approach may be available for reducing chronic diseases associated with inflammation," he concluded.

Recommended daily intakes of choline were set in 1998 at 550 milligrams per day for men and 425 milligrams a day for women. No RDI has been set for betaine, which, since it is a metabolite of choline, is not considered an essential nutrient.

Practical Tip: Egg yolks are the richest source of choline, followed by soybeans. Spinach, beets and whole wheat products are primary sources of betaine. (Olthof MR, van Vliet T, et al. J Nutr)

Whole Grains Help Prevent Gallstones

Eating foods high in insoluble fiber, such as cereals and breads made from whole wheat, can help women avoid gallstones, shows a study published in the *American Journal of Gastroenterology*.

Studying the overall fiber intake and types of fiber consumed over a 16 year period by over 69,000 women in the Nurses Health Study, researchers found that those consuming the most fiber overall (both soluble and insoluble) had a 13% lower risk of developing gallstones compared to women consuming the fewest fiber-rich foods.

Those eating the most foods rich in insoluble fiber gained even more protection against gallstones: a 17% lower risk compared to women eating the least. And the protection was dose-related; a 5-gram increase in insoluble fiber intake dropped risk dropped 10%.

How do foods rich in insoluble fiber help prevent gallstones? Researchers think insoluble fiber not only speeds intestinal transit time (how quickly food moves through the intestines), but reduces the secretion of bile acids (excessive amounts contribute to gallstone formation), increases insulin sensitivity and lowers triglycerides (blood fats). Abundant in all whole grains, insoluble fiber is also found in nuts and the edible skin of fruits and vegetables including tomatoes, cucumbers, many squash, apples, berries, and pears. In addition, beans provide insoluble as well as soluble fiber.

Whole Wheat Gets You Going

Wheat bran is a popular bulk laxative. A third of a cup per day is all that is needed. Research studies support this popular practice. A fiber-rich diet, primarily composed of whole wheat breads, cereals high in bran and supplemental "millers bran" was shown to alleviate the symptoms of diverticular disease (pain, nausea, flatulence, distension, constipation, etc.) in 89 percent of patients enrolled in a study which examined the effects of fiber on bowel regularity. Diverticular disease, a condition often marked by inflammation and lower abdominal pains in which chronic constipation and excessive straining results in a sac or pouch in the wall of the colon, is typically treated with dietary roughage such as cereal fiber (i.e., wheat bran), fruit and vegetable fiber, and plenty of fluids.

Whole Wheat Promotes Women's Health and Gastrointestinal Health

The benefits of wheat's bran portion don't stop here; it has also been shown to function as an anti-cancer agent. Wheat bran is thought to accelerate the metabolism of estrogen that is a known promoter of breast cancer. In one study, pre-menopausal women, ages twenty to fifty, who ate three to four high fiber muffins per day made with wheat bran, decreased their blood estrogen levels by 17 percent after two months. The women eating corn bran or oat bran did not show the same benefits.

Interestingly, whole grains such as wheat also contain *lignans*, which are phytonutrients that act as weak hormone-like substances. *Lignans* occupy the hormone receptors in the body, thus actively protecting the breast against high circulating levels of hormones such as estrogen. By accelerating the metabolism of estrogen and occupying estrogen receptors in the body, the components of wheat appear to have a dual function in protecting women against one of the leading causes of cancer death.

The fact that only wheat bran, and not corn or oat bran, is beneficial in preventing cancer-promoting changes in the colon, provides additional clues that wheat bran contains something special that makes it a true cancer fighter. Only the bran from wheat has been shown to reduce the concentration of bile acids and bacterial enzymes in the stool that are believed to promote colon cancer.

The protective dose for colon cancer may be more than 28 grams a day, since men who ate this amount had only one-third the rate of colon polyps (precancerous tumors) compared to those who ate only 17 grams/day. The amount of wheat bran needed for protection from other cancers is still unknown, but based on the health benefits of this food, it may be wise, if you are not sensitive to wheat or gluten, to include several servings of whole wheat grain foods such as bread, pasta, and bran cereals every day in your diet.

Fiber from Whole Grains and Fruit Protective against Breast Cancer

When researchers looked at how much fiber 35,972 participants in the UK Women's Cohort Study ate, they found a diet rich in fiber from whole grains, such as whole wheat, and fruit offered significant protection against breast cancer for pre-menopausal women. (Cade JE, Burley VJ, et al., *International Journal of Epidemiology*).

Pre-menopausal women eating the most fiber (>30 grams daily) more than halved their risk of developing breast cancer, enjoying a 52% lower risk of breast cancer compared to women whose diets supplied the least fiber (<20 grams/day).

Fiber supplied by whole grains offered the most protection. Pre-menopausal women eating the most whole grain fiber (at least 13 g/day) had a 41% reduced risk of breast cancer, compared to those with the lowest whole grain fiber intake (4 g or less per day).

Fiber from fruit was also protective. Pre-menopausal women whose diets supplied the most fiber from fruit (at least 6 g/day) had a 29% reduced risk of breast cancer, compared to those with the lowest fruit fiber intake (2 g or less per day).

Practical Tip: As the following table shows, it's surprisingly easy to enjoy a healthy way of eating that delivers at least 13 grams of whole grain fiber and 6 grams of fiber from fruit each day.

Food	Fiber Content in Grams
Oatmeal, 1 cup	3.98
Whole wheat bread, 1 slice	2
Whole wheat spaghetti, 1 cup	6.3
Brown rice, 1 cup	3.5
Barley, 1 cup	13.6
Buckwheat, 1 cup	4.54
Rye, 1/3 cup	8.22
Corn, 1 cup	4.6
Apple, 1 medium with skin	5.0
Banana, 1 medium	4.0
Blueberries, 1 cup	3.92
Orange, 1 large	4.42
Pear, 1 large	5.02
Prunes, 1/4 cup	3.02
Strawberries, 1 cup	3.82
Raspberries, 1 cup	8.36

*Fiber content can vary between brands. Source: esha Research, Food Processor for Windows, Version 7.8

Cereal and Fruit Fiber Protective against Postmenopausal Breast Cancer

Results of a prospective study involving 51,823 postmenopausal women for an average of 8.3 years showed a 34% reduction in breast cancer risk for those consuming the most fruit fiber compared to those consuming the least. In addition, in the subgroup of women who had ever used hormone replacement, those consuming the most fiber, especially cereal fiber, had a 50% reduction in their risk of breast cancer compared to those consuming the least.

Fruits richest in fiber include apples, dates, figs, pears and prunes. When choosing a high fiber cereal, look for whole grain cereals as they supply the most bran (a mere 1/3rd cup of bran contains about 14 grams of fiber). Enjoy a cup of bulgur wheat as part of your lunch or dinner, and, for just 151 calories, you'll have consumed more than a third of your RDI for fiber.

Whole Grains and Fish Highly Protective against Childhood Asthma

According to the American Lung Association, almost 20 million Americans suffer from asthma, which is reported to be responsible for over 14 million lost school days in children, and an annual economic cost of more than $16.1 billion.

Increasing consumption of whole grains and fish could reduce the risk of childhood asthma by about 50%, suggests the International Study on Allergy and Asthma in Childhood (Tabak C, Wijga AH, *Thorax*).

The researchers, from the Dutch National Institute of Public Health and the Environment, Utrecht University, University Medical Center Groningen, used food frequency questionnaires completed by the parents of 598 Dutch children aged 8-13 years. They assessed the children's consumption of a range of foods including fish, fruits, vegetables, dairy and whole grain products. Data on asthma and wheezing were also assessed using medical tests as well as questionnaires.

While no association between asthma and intake of fruits, vegetables, and dairy products was found (a result at odds with other studies that have supported a link between antioxidant intake, particularly vitamins C and E, and asthma), the children's intake of both whole grains and fish was significantly linked to incidence of wheezing and current asthma.

In children with a low intake of fish and whole grains, the prevalence of wheezing was almost 20%, but was only 4.2% in children with a high intake of both foods. Low intake of fish and whole grains also correlated with a much higher incidence of current asthma (16.7%). compared to only a 2.8% incidence of current asthma among children with a high intake of both foods.

After adjusting results for possible confounding factors, such as the educational level of the mother, and total energy intake, high intakes of whole grains and fish were found to be associated with a 54 and 66% reduction in the probability of being asthmatic, respectively.

The probability of having asthma with bronchial hyperresponsiveness (BHR), defined as having an increased sensitivity to factors that cause narrowing of the airways, was reduced by 72 and 88% when children had a high-intake of whole grains and fish, respectively. Lead researcher, CoraTabak commented, "The rise in the prevalence of asthma in western societies may be related to changed dietary habits." We agree. The Standard American Diet is sorely deficient in the numerous anti-inflammatory compounds found in fish and whole grains, notably, the omega-3 fats supplied by cold water fish and the magnesium and vitamin E provided by whole grains. One caution: wheat may need to be avoided as it is a common food allergen associated with asthma.

Phytochemicals with Health-Promoting Activity Equal to or Even Higher than that of Vegetables and Fruits

Research reported at the American Institute for Cancer Research (AICR) International Conference on Food, Nutrition and Cancer, by Rui Hai Liu, M.D., Ph.D., and his colleagues at Cornell University shows that whole grains, such as whole wheat, contain many powerful phytonutrients whose activity has gone unrecognized because research methods have overlooked them.

Despite the fact that for years researchers have been measuring the antioxidant power of a wide array of phytonutrients, they have typically measured only the "free" forms of these substances, which dissolve quickly and are immediately absorbed into the bloodstream. They have not looked at the "bound" forms, which are attached to the walls of plant cells and must be released by intestinal bacteria during digestion before they can be absorbed.

Phenolics, powerful antioxidants that work in multiple ways to prevent disease, are one major class of phytonutrients that have been widely studied. Included in this broad category are such compounds as quercetin, curcumin, ellagic acid, catechins, and many others that appear frequently in the health news.

When Dr. Liu and his colleagues measured the relative amounts of phenolics, and whether they were present in bound or free form, in common fruits and vegetables like apples, red grapes, broccoli and spinach, they found that phenolics in the "free" form averaged 76% of the total number of phenolics in these foods. In whole grains, however, "free" phenolics accounted for less than 1% of the total, while the remaining 99% were in "bound" form.

In his presentation, Dr. Liu explained that because researchers have examined whole grains with the same process used to measure antioxidants in vegetables and fruits—looking for their content of "free" phenolics"—the amount and activity of antioxidants in whole grains has been vastly underestimated.

Despite the differences in fruits', vegetables' and whole grains' content of "free" and "bound" phenolics, the total antioxidant activity in all three types of whole foods is similar, according to Dr. Liu's research. His team measured the antioxidant activity of various foods, assigning each a rating based on a formula (micromoles of vitamin C equivalent per gram). Broccoli and spinach measured 80 and 81, respectively; apple and banana measured 98 and 65; and of the whole grains tested, corn measured 181, whole wheat 77, oats 75, and brown rice 56.

Dr. Liu's findings may help explain why studies have shown that populations eating diets high in fiber-rich whole grains consistently have lower risk for colon cancer, yet short-term clinical trials that have focused on fiber alone in lowering colon cancer risk, often to the point of giving subjects isolated fiber supplements, yield inconsistent results. The explanation is most likely that these studies have not taken into account the interactive effects of all the nutrients in whole grains—not just their fiber, but also their many phytonutrients. As far as whole grains are concerned, Dr. Liu believes that the key to their powerful cancer-fighting potential is precisely their wholeness. A grain of whole wheat consists of three parts—its endosperm (starch), bran and germ. When wheat—or any whole grain—is refined, its bran and germ are removed. Although these two parts make up only 15-17% of the grain's weight, they contain 83% of its phenolics. Dr. Liu says his recent findings on the antioxidant content of whole grains reinforce the message that a variety of foods should be eaten good health. "Different plant foods have different phytochemicals," he said. "These substances go to different organs, tissues and cells, where they perform different functions. What your body needs to ward off disease is this synergistic effect—this teamwork—that is produced by eating a wide variety of plant foods, including whole grains."

Lignans Protect against Heart Disease

One type of phytonutrient especially abundant in whole grains including whole wheat are plant lignans, which are converted by friendly flora in our intestines into mammalian lignans, including one called enterolactone that is thought to protect against breast and other hormone-dependent cancers as well as heart disease. In addition to whole grains, nuts, seeds and berries are rich sources of plant lignans, and vegetables, fruits, and beverages such as coffee, tea and wine also contain some. When blood levels of enterolactone were measured in over 800 postmenopausal women in a Danish study published in the *Journal of Nutrition*, women eating the most whole grains were found to have significantly higher blood levels of this protective lignan. Women who ate more cabbage and leafy vegetables also had higher enterolactone levels.

Significant Cardiovascular Benefits for Postmenopausal Women

Eating a serving of whole grains, such as whole wheat, at least 6 times each week is an especially good idea for postmenopausal women with high cholesterol, high blood pressure or other signs of cardiovascular disease (CVD).

A 3-year prospective study of 229 postmenopausal women with CVD, published in the *American Heart Journal*, shows that those eating at least 6 servings of whole grains each week experienced both:

- Slowed progression of atherosclerosis, the build-up of plaque that narrows the vessels through which blood flows, and
- Less progression in stenosis, the narrowing of the diameter of arterial passageways.

The women's intake of fiber from fruits, vegetables and refined grains was *not* associated with a lessening in CVD progression.

Prevent Heart Failure with a Whole Grains Breakfast

Heart failure is the leading cause of hospitalization among the elderly in the United States. Success of drug treatment is only partial (ACE inhibitors and beta-blockers are typically used; no evidence has found statins safe or effective for heart failure), and its prognosis remains poor. Follow up of 2445 discharged hospital patients with heart failure revealed that 37.3% died during the first year, and 78.5% died within 5 years.

Since consumption of whole grain products and dietary fiber has been shown to reduce the risk of high blood pressure and heart attack, Harvard researchers decided to look at the effects of cereal consumption on heart failure risk and followed 21,376 participants in the Physicians Health Study over a period of 19.6 years.

After adjusting for confounding factors (age, smoking, alcohol consumption, vegetable consumption, use of vitamins, exercise, and history of heart disease), they found that men who simply enjoyed a daily morning bowl of whole grain (but not refined) cereal had a 29% lower risk of heart failure. Isn't your heart worth protecting, especially when the prescription—a morning bowl of hearty whole grains—is so delicious? For quick, easy, heart-healthy, whole grain recipes, click The World's Healthiest Foods, and look at the "How to Enjoy" section in any of our grain profiles.

A "Germ" that Promotes Health

Wheat bran is not the only star when it comes to the health benefits of wheat; wheat germ definitely deserves its "health food" reputation. The germ is the vitamin and mineral rich embryo of the wheat kernel that is removed during the refining of whole wheat grains to white flour. Packed with important B vitamins, such as folate, thiamin, and vitamin B6, and the minerals zinc, magnesium, and manganese, wheat germ is a top-notch food that can be easily incorporated into casseroles, muffins, and pancakes or sprinkled over cereal or yogurt.

The wheat germ also has a high oil content, and subsequently a high amount of vitamin E, a powerful antioxidant that helps protect the oil in the wheat germ from quickly becoming rancid. Vitamin E functions in a similar manner as a fat-soluble antioxidant in the human body where it helps protect fat-containing substances including cell membranes, brain cells, and fatty molecules such as cholesterol from damge by free radicals. Fats and cholesterol are very susceptible to free radical damage, a process that occurs when they are exposed to oxygen. When damaged, fats and cholesterol form toxic derivatives that, if left unchecked, can damage the structures of which they are a part and, in the case of cholesterol, contribute to the formation of atherosclerosis, a form of coronary artery disease. Vitamin E, when present in sufficient quantities, readily blocks these toxic derivatives.

Vitamin E not only protects fats, cholesterol and all cell membranes from damage, it is also important for immune system function, cancer prevention and blood glucose control in both healthy and diabetic individuals.

Meta-analysis Explains Whole Grains' Health Benefits

In many studies, eating whole grains, such as whole wheat, has been linked to protection against atherosclerosis, ischemic stroke, diabetes, insulin resistance, obesity, and premature death. A new study and accompanying editorial, published in the *American Journal of Clinical Nutrition* explains the likely reasons behind these findings and recommends at least 3 servings of whole grains should be eaten daily.

Whole grains are concentrated sources of fiber. In this meta-analysis of 7 studies including more than 150,000 persons, those whose diets provided the highest dietary fiber intake had a 29% lower risk of cardiovascular disease compared to those with the lowest fiber intake.

But it's not just fiber's ability to serve as a bulking agent that is responsible for its beneficial effects as a component of whole grains. Wheat bran, for example, which constitutes 15% of most whole-grain wheat kernels but is virtually non-existent in refined wheat flour, is rich in minerals, antioxidants, lignans, and other phytonutrients—as well as in fiber.

In addition to the matrix of nutrients in their dietary fibers, the whole-grain arsenal includes a wide variety of additional nutrients and phytonutrients that reduce the risk of cardiovascular disease. Compounds in whole grains that have cholesterol-lowering effects include polyunsaturated fatty acids, oligosaccharides, plant sterols and stanols, and saponins.

Whole grains are also important dietary sources of water-soluble, fat-soluble, and insoluble antioxidants. The long list of cereal antioxidants includes vitamin E, tocotrieonols, selenium, phenolic acids, and phytic acid. These multifunctional antioxidants come in immediate-release to slow-release forms and thus are available throughout the gastrointestinal tract over a long period after being consumed.

The high antioxidant capacity of wheat bran is 20-fold that of refined wheat flour (endosperm). Although the role of antioxidant supplements in protecting against cardiovascular disease has been questioned, prospective population studies consistently suggest that when consumed in whole foods, antioxidants are associated with significant protection against cardiovascular disease. Because free radical damage to cholesterol appears to contribute significantly to the development of atherosclerosis, the broad range of antioxidant activities from the phytonutrients abundant in whole-grains is thought to play a strong role in their cardio-protective effects.

Like soybeans, whole grains are important sources of phytoestrogens, plant compounds that may affect blood cholesterol levels, blood vessel elasticity, bone metabolism, and many other cellular metabolic processes.

Whole grains are rich sources of lignans that are converted by the human gut to enterolactone and enterodiole. In studies of Finnish men, blood levels of enterolactone have been found to have an inverse relation not just to cardiovascular-related death, but to all causes of death, which suggests that the plant lignans in whole grains may play an important role in their protective effects.

Lower insulin levels may also contribute to the protective effects of whole grains. In many persons, the risks of atherosclerotic cardiovascular disease, diabetes, and obesity are linked to insulin resistance. Higher intakes of whole grains are associated with increased sensitivity to insulin in population studies and clinical trials. Why? Because whole grains improve insulin sensitivity by lowering the glycemic index of the diet while increasing its content of fiber, magnesium, and vitamin E.

The whole kernel of truth: as part of your healthy way of eating, whole grains can significantly lower your risk of cardiovascular disease, obesity and type 2 diabetes. Enjoy at least 3 servings a day. No idea how to cook whole grains? Just look at the "How to Enjoy" section in our profiles of the whole grains, or for quick, easy, delicious recipes, click on this link to our Recipe Assistant and select whichever whole grain you would like to prepare.

Sourdough bread—a Better Source of Minerals and Potentially Better Tolerated by Persons with Wheat-Related Health Problems

Choose sourdough for the best nutrition among commercially baked breads, suggests a study published in the journal *Nutrition*.

This animal study compared mineral absorption from different breads: reconstituted whole wheat flour (white flour plus bran, a typical formulation), yeast bread and sourdough bread. Of all three breads, not only was the content of phytate, which prevents absorption of calcium, lower in sourdough, but the absorption of iron, zinc, and copper was enhanced. Another study, published in *Applied and Environmental Microbiology* showed that sourdough bread fermented with the help of selected *Lactobacilli*, nontoxic flours, and a long fermentation time was fairly well tolerated by a group of 17 persons previously diagnosed with celiac disease. Although the purpose of this study was to help develop a prototype wheat bread product that might be tolerated by persons with wheat sensitivity, the results of this study seem promising for future attempts to prepare wheat in a natural way that may improve its tolerability.

Description

Wheat is ubiquitious in our culture in the food culture of North America as well as other regions around the world. Bread, pasta, bagels, crackers, cakes, and muffins just begin to describe the list of foods made with this grain.

Wheat is generally classified as being either spring or winter wheat. Within these two groups, the wheat can be further defined as being either hard or soft, depending upon the grain's texture. The colors of the grains of wheat are white or red with reflections of amber.

Wheat, in its natural unrefined state, features a host of important nutrients. Therefore, to receive benefit from the wholesomeness of wheat you need to choose wheat products made from whole wheat flour rather than those that are refined and stripped of their natural goodness.

The genus name for wheat, from which all wheat species are derived, is *Triticum*.

History

Wheat is an ancient grain. Thought to have originated in southwestern Asia, it has been consumed as a food for more than 12,000 years. As it was looked upon as the Staff of Life, it played an important role of religious significance and was part of the sacred rituals of many cultures. Greek, Roman, Sumerian and Finnish mythology had gods and goddesses of wheat. This exceptionally nutritious grain is still considered to be sacred in some areas of China.

Wheat was not native to the Western Hemisphere and was only introduced here in the late 15th century when Columbus came to the New World. While wheat was grown in the United States during the early colonial years, it was not until the late 19th century that wheat cultivation flourished, owing to the importation of an especially hardy strain of wheat known as Turkey red wheat, which was brought over by Russian immigrants who settled in Kansas.

As rice has been the dietary staple of Asia, wheat has served this role for many of other regions of the world. It is estimated that approximately one-third of the world's people depend upon wheat for their nourishment.

Today, the largest commercial producers of wheat include the Russian Federation, the United States, China, India, France and Canada.

How to Select and Store

Wheat flour, berries and bulgur are generally available prepackaged as well as in bulk containers. Just as with any other food that you may purchase in the bulk section, make sure that the bins containing these wheat products are covered and that the store has a good product turnover so as to ensure their maximal freshness. Whether purchasing these products in bulk or in a packaged container, make sure that there is no evidence of moisture present.

Look for wheat germ that is packaged in sealed containers (especially those that are vacuum packaged) as they will be more protected from potential oxidation and rancidity.

Wheat berries should be stored in an airtight container in a cool, dry and dark place. The optimal way to store wheat products such as flour, bulgur, bran and germ is in an airtight container in the refrigerator as the cooler temperature will help to prevent them from becoming rancid.

How to Enjoy

A Few Quick Serving Ideas

Use whole wheat bread when you make sandwiches.

Wheat flakes look similar to rolled oats and can be prepared as a hot breakfast cereal.

Use sprouted wheat berries in vegetable and grain salads.

Make individual pizzas using whole wheat pita breads as the crust.

Whole wheat pasta has become very popular and is available in many different types (e.g., spaghetti, spirals, penne, etc.) to suit your recipe needs.

For some of our favorite recipes, click Recipes.

Safety

Whole Wheat and Food Allergies

Wheat is among the eight food types considered to be major food allergens in the U.S., requiring identification on food labels. For helpful information about this topic, please see our article, An Overview of Adverse Food Reactions.

Baked and Toasted Wheat-Containing Foods and Acrylamides

Whole wheat is not a concern when it comes to acrylamide, a potentially toxic and potentially cancer-causing substance. Yet, baked snack foods containing wheat and sugar—including cookies and crackers—and processed foods involving toasted grains—including toasted wheat cereals—are considered among the highest risk of foods when it comes to acrylamide exposure. This is yet another reason to avoid or minimize your intake of these foods. For more on acrylamides, see our detailed write-up on the subject.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating.

Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Wheat, bulgar, cooked **1.00 cup** **182.00 grams**				**Calories: 151** **GI: low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
manganese	1.11 mg	56	6.6	very good
fiber	8.19 g	33	3.9	very good
copper	0.14 mg	16	1.9	good
magnesium	58.24 mg	15	1.7	good
pantothenic acid	0.63 mg	13	1.5	good

World's Healthiest Foods Rating	**Rule**
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Basil

The round, often pointed leaves of the basil plant looks a lot like peppermint to which it is related. Its highly fragrant leaves are used as a seasoning herb for a variety of foods but has become ever popular as the main ingredient in pesto, the mixture of basil, pine nuts and parmesan cheese.

Basil, chopped, fresh
0.50 cup
(21.20 grams)

Calories: 5
GI: very low

Nutrient	DRI/DV
vitamin K	98%
manganese	12%
copper	9%
vitamin A	6%
vitamin C	5%
calcium	4%
folate	4%
iron	4%
omega-3 fats	3%
magnesium	3%

Health Benefits

Research studies on basil have shown unique health-protecting effects in two basic areas: basil's flavonoids and volatile oils.

DNA Protection Plus Anti-Bacterial Properties

The unique array of active constituents called *flavonoids* found in basil provide protection at the cellular level. *Orientin* and *vicenin* are two water-soluble flavonoids that have been of particular interest in basil, and in studies on human white blood cells; these components of basil protect cell structures as well as chromosomes from radiation and oxygen-based damage.

In addition, basil has been shown to provide protection against unwanted bacterial growth. These anti-bacterial properties of basil are not associated with its unique flavonoids, but instead with its volatile oils, which contain *estragole*, *linalool*, *cineole*, *eugenol*, *sabinene*, *myrcene*, and *limonene*. Lab studies show the effectiveness of basil in restricting growth of numerous bacteria, including : *Listeria monocytogenes*, *Staphylococcus aureus*, *Escherichia coli* O:157:H7, *Yersinia enterocolitica*, and *Pseudomonas aeruginosa*.

Essential oil of basil, obtained from its leaves, has demonstrated the ability to inhibit several species of pathogenic bacteria that have become resistant to commonly used antibiotic drugs. In a study published in the July 2003 issue of the *Journal of Microbiology Methods*, essential oil of basil was even found to inhibit strains of bacteria from the genera *Staphylococcus*, *Enterococcus* and *Pseudomonas*, all of which are not only widespread, but now pose serious treatment difficulties because they have developed a high level of resistance to treatment with antibiotic drugs.(September 8, 2003)
Studies published in the February 2004 issue of *Food Microbiology*, have shown that washing produce in solution containing either basil or thyme essential oil at the very low concentration of just 1% resulted in dropping the number of *Shigella*, an infectious bacteria that triggers diarrhea and may cause significant intestinal damage, below the point at which it could be detected. While scientists use this research to try to develop natural food preservatives, it makes good sense to include basil and thyme in more of your recipes, particularly for foods that are not cooked such as salads. Adding fresh thyme and/or basil to your next vinaigrette will not only enhance the flavor of your fresh greens, but will help ensure that the fresh produce you consume is safe to eat. (March 25, 2004)

Anti-Inflammatory Effects

The eugenol component of basil's volatile oils has been the subject of extensive study, since this substance can block the activity of an enzyme in the body called *cyclooxygenase* (COX). Many non-steriodal over-the-counter anti-inflammatory medications (NSAIDS), including aspirin and ibuprofen, as well as the commonly used medicine acetaminophen, work by inhibiting this same enzyme. (In the case of acetaminophen, this effect is somewhat controversial, and probably occurs to a much lesser degree than is the case with aspirin and ibuprofen). This enzyme-inhibiting effect of the eugenol in basil qualifies basil as an "anti-inflammatory" food that can provide important healing benefits along with symptomatic relief for individuals with inflammatory health problems like rheumatoid arthritis or inflammatory bowel conditions.

Nutrients Essential for Cardiovascular Health

Want to enrich the taste and cardiovascular health benefits of your pasta sauce? Add a good helping of basil. Basil is a very good source of vitamin A (through its concentration of carotenoids such as beta-carotene). Called "pro-vitamin A," since it can be converted into vitamin A, beta-carotene is a more powerful anti-oxidant than vitamin A and not only protects *epithelial cells* (the cells that form the lining of numerous body structures including the blood vessels) from free radical damage, but also helps prevent free radicals from oxidizing cholesterol in the blood stream. Only after it has been oxidized does cholesterol build up in blood vessel walls, initiating the development of atherosclerosis, whose end result can be a heart attack or stroke.

Free radical damage is a contributing factor in many other conditions as well, including asthma, osteoarthritis, and rheumatoid arthritis. The beta-carotene found in basil may help to lessen the progression of these conditions while protecting cells from further damage.

Basil is also a good source of magnesium, which promotes cardiovascular health by prompting muscles and blood vessels to relax, thus improving blood flow and lessening the risk of irregular heart rhythms or a spasming of the heart muscle or a blood vessel.

In addition to the health benefits and nutrients described above, basil also emerged from our food ranking system as an excellent source of vitamin K and manganese, a very good source of copper and vitamin C, and a good source of calcium, iron, folate and omega-3 fatty acids.

Description

Basil is a highly fragrant plant whose leaves are used as a seasoning herb for many different types of foods. Basil has become one of the most recognizable herbs ever since pesto, the mixture of basil, pine nuts and Parmesan cheese, has become popular.

Basil has round leaves that are oftentimes pointed. They are green in color, although some varieties feature hints of red or purple. Basil looks a little like peppermint, which is not surprising since they belong to the same plant family.

There are more than 60 varieties of basil, all of which differ somewhat in appearance and taste. While the taste of sweet basil is bright and pungent, other varieties also offer unique tastes: lemon basil, anise basil and cinnamon basil all have flavors that subtly reflect their name. The scientific name for basil is *Ocimum basilicum*.

History

Basil now grows in many regions throughout the world, but it was first native to India, Asia and Africa. It is prominently featured in varied cuisines throughout the world including Italian, Thai, Vietnamese and Laotian.

The name "basil" is derived from the old Greek word *basilikohn*, which means "royal," reflecting that ancient culture's attitudes towards an herb that they held to be very noble and sacred. The tradition of reverence of basil has continued in other cultures. In India, basil was cherished as an icon of hospitality, while in Italy, it was a symbol of love.

How to Select and Store

Whenever possible, choose fresh basil over the dried form of the herb since it is superior in flavor. The leaves of fresh basil should look vibrant and be deep green in color. They should be free from darks spots or yellowing.

Even through dried herbs and spices like basil are widely available in supermarkets, you may want to explore the local spice stores in your area. Oftentimes, these stores feature an expansive selection of dried herbs and spices that are of superior quality and freshness compared to those offered in regular markets. Just like with other dried herbs, when purchasing dried basil, try to select organically grown basil since this will give you more assurance that it has not been irradiated (among other potential adverse effects, irradiating basil may lead to a significant decrease in its vitamin C and carotenoid content.)

Fresh basil should be stored in the refrigerator wrapped in a slightly damp paper towel. It may also be frozen, either whole or chopped, in airtight containers. Alternatively, you can freeze the basil in ice cube trays covered with either water or stock that can be added when preparing soups or stews. Dried basil should be kept in a tightly sealed glass container in a cool, dark and dry place where it will keep fresh for about six months.

How to Enjoy

A Few Quick Serving Ideas:

- Combine fresh chopped basil with garlic and olive oil to make a dairy-free variety of pesto that can top a variety of dishes including pasta, salmon and whole wheat brushetta.
- Enjoy a taste of Italy by layering fresh basil leaves over tomato slices and mozzarella cheese to create this traditional colorful and delicious salad.
- Adding basil to healthy stir-fries, especially those that include eggplant, cabbage, chili peppers, tofu and cashew nuts will give them a Thai flair.
- Purée basil, olive oil and onions in a food processor or blender and add to tomato soups.
- Enjoy a warm cup of invigorating basil tea by infusing chopped basil leaves in boiling water for eight minutes.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Basil, chopped, fresh
0.50 cup
21.20 grams

Calories: 5
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin K	87.94 mcg	98	360.4	excellent
manganese	0.24 mg	12	44.3	excellent
copper	0.08 mg	9	32.8	very good
vitamin A	55.91 mcg RAE	6	22.9	very good
vitamin C	3.82 mg	5	18.8	very good
calcium	37.52 mg	4	13.8	good
iron	0.67 mg	4	13.7	good
folate	14.42 mcg	4	13.3	good
magnesium	13.57 mg	3	12.5	good
omega-3 fats	0.07 g	3	10.8	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Black pepper

A pinch of black pepper is added to almost every type of recipe imaginable. Once used as currency and presented to the gods as a sacred offering, it is fortunate that this most popular of spices is available throughout the year.

Black pepper comes from the pepper plant, a smooth woody vine that can grow up to 33 feet in hot and humid tropical climates. They begin to bear small white clustered flowers after 3 to 4 years and develop into berries known as peppercorns. Ground peppercorns produce the spice we call pepper.

Black Pepper, whole peppercorns
2.00 tsp
(5.80 grams)

Calories: 15
GI: very low

Nutrient	DRI/DV
manganese	37%
vitamin K	11%
copper	9%
fiber	6%
calcium	3%
chromium	3%
iron	3%

Health Benefits

Improve Digestion and Promote Intestinal Health

Black pepper (*Piper nigrum*)stimulates the taste buds in such a way that an alert is sent to to the stomach to increase hydrochloric acid secretion, thereby improving digestion. Hydrochloric acid is necessary for the digestion of proteins and other food components in the stomach. When the body's production of hydrochloric acid is insufficient, food may sit in the stomach for an extended period of time, leading to heartburn or indigestion, or it may pass into the intestines, where it can be used as a food source for unfriendly gut bacteria, whose activities produce gas, irritation, and/or diarrhea or constipation.

Black pepper has long been recognized as a *carminitive*, (a substance that helps prevent the formation of intestinal gas), a property likely due to its beneficial effect of stimulating hydrochloric acid production. In addition, black pepper has *diaphoretic* (promotes sweating), and *diuretic* (promotes urination) properties.

Black pepper has demonstrated impressive antioxidant and antibacterial effects--yet another way in which this wonderful seasoning promotes the health of the digestive tract. And not only does black pepper help you derive the most benefit from your food, the outer layer of the peppercorn stimulates the breakdown of fat cells, keeping you slim while giving you energy to burn.

Description

Black pepper comes from the berries of the pepper plant. Black pepper, green pepper and white peppercorns are actually the same fruit (*Piper nigrum*); the difference in their color is a reflection of varying stages of development and processing methods.

Black peppercorns are made by picking the pepper berries when they are half ripe and just about to turn red. They are then left to dry which causes them to shrivel and become dark in color. Alternatively, green peppercorns are picked while still unripe and green in color, while white peppercorns are picked when very ripe and subsequently soaked in brine to remove their dark outer shell leaving just the white pepper seed.

Pink peppercorns are actually from a completely different plant species (*Schinus molle*) that is related to ragweed.

Black pepper is the most pungent and flavorful of all types of peppers and it is available as whole or cracked peppercorns or ground into powder.

History

Native to India, pepper has played a very important role throughout history and has been a prized spice since ancient times. Since ancient Greece, pepper has held such high prestige that it was not only used as a seasoning but as a currency and a sacred offering. Pepper was used to both honor the gods and to pay taxes and ransoms. During the fall of ancient Rome, the invading barbarians were even honored by being given black pepper. Additionally, in the Middle Ages the wealth of a man was oftentimes measured by his stockpile of pepper.

The reason that pepper was so cherished is that it served important culinary purposes. Not only could its pungency spice up otherwise bland foods, but it could disguise a food's lack of freshness, the latter being an especially important quality in the times before efficient means of preservation.

Pepper became an important spice that catalyzed much of the spice trade. This not only led to exploration of many undiscovered lands, but also to the development of major merchant cities in Europe and the Middle East.

Today, the major commercial producers of pepper are India and Indonesia.

How to Select and Store

Black pepper is available whole, crushed or ground into powder. To ensure best flavor, buy whole peppercorns and grind them yourself in a mill just before adding to a recipe. In addition to superior flavor, buying whole peppercorns will help to ensure that you are purchasing unadulterated pepper since ground pepper is oftentimes mixed with other spices. Whole peppercorns should be heavy, compact and free of any blemishes.

Even through dried herbs and spices like black pepper are widely available in supermarkets, you may want to explore the local spice stores in your area. Oftentimes, these stores feature an expansive selection of dried herbs and spices that are of superior quality and freshness than those offered in regular markets. Just like with other dried spices, when purchasing black pepper try to select that which is organically grown since this will give you more assurance that it has not been irradiated (among other potential adverse effects, irradiating black pepper may lead to a significant decrease in its vitamin C content.)

Black pepper should be kept in a tightly sealed glass container in a cool, dark and dry place. Whole peppercorns will keep almost indefinitely, while ground pepper will stay fresh for about three months. Pepper can also be frozen although this will make its flavor more pronounced.

How to Enjoy

A Few Quick Serving Ideas

- Coat steaks with crushed peppercorns before cooking to create the classic dish, steak au poivre.
- As the pungent taste of black pepper is a natural complement to the deep, berry-like flavor of venison, use it to flavor this meat when preparing venison steaks or venison stews.
- Keep a pepper mill on your dining table so that you can add its intense spark to a host of different recipes that you prepare.
- Olive oil, lemon juice, salt and cracked pepper make a delicious salad dressing.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating.

Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Black Pepper, whole peppercorns
2.00 tsp
5.80 grams

Calories: 15
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
manganese	0.74 mg	37	45.7	excellent
vitamin K	9.49 mcg	11	13.0	excellent
copper	0.08 mg	9	11.0	very good
fiber	1.47 g	6	7.3	very good
iron	0.56 mg	3	3.8	good
chromium	0.93 mcg	3	3.3	good
calcium	25.69 mg	3	3.2	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Chili pepper, dried

About Chili Pepper

Chili peppers are available throughout the year to add zest to flavorful dishes around the world and health to those brave enough to risk their fiery heat.

This is the plant that puts fire on your tongue and maybe even a tear in your eye when you eat spicy Mexican, simmering Szechuan, smoldering Indian, or torrid Thai food. Chili peppers belong to the family of foods bearing the Latin name *Capsicum*.

Chili Peppers, hot, dried
2.00 tsp
(5.40 grams)

Calories: 15
GI: very low

Nutrient	DRI/DV
vitamin E	14%
vitamin A	9%
fiber	8%
vitamin K	6%
copper	6%
vitamin B6	6%
iron	5%
manganese	5%
vitamin B2	4%
vitamin B3	4%
potassium	3%

Health Benefits

Fight Inflammation

Chili peppers contain a substance called *capsaicin*, which gives peppers their characteristic pungence, producing mild to intense spice when eaten. Capsaicin is a potent inhibitor of substance P, a neuropeptide associated with inflammatory processes. The hotter the chili pepper, the more capsaicin it contains. The hottest varieties include habanero and Scotch bonnet peppers. Jalapenos are next in their heat and capsaicin content, followed by the milder varieties, including Spanish pimentos, and Anaheim and Hungarian cherry peppers.

Capsaicin is being studied as an effective treatment for sensory nerve fiber disorders, including pain associated with arthritis, psoriasis, and diabetic neuropathy. When animals injected with a substance that causes inflammatory arthritis were fed a diet that contained capsaicin, they had delayed onset of arthritis, and also significantly reduced paw inflammation.

Natural Pain Relief

Topical capsaicin is now a recognized treatment option for osteoarthritis pain. Several review studies of pain management for diabetic neuropathy have listed the benefits of topical capsaicin to alleviate disabling pain associated with this condition.

In a double-blind placebo controlled trial, nearly 200 patients with psoriasis were given topical preparations containing either capsaicin or placebo. Patients who were given capsaicin reported significant improvement based on a severity score which traced symptoms associated with psoriasis. The side effect reported with topical capsaicin cream is a burning sensation at the area of application.

Cardiovascular Benefits

Red chili peppers, such as cayenne, have been shown to reduce blood cholesterol, triglyceride levels, and platelet aggregation, while increasing the body's ability to dissolve fibrin, a substance integral to the formation of blood clots. Cultures where hot pepper is used liberally have a much lower rate of heart attack, stroke and pulmonary embolism.

Spicing your meals with chili peppers may also protect the fats in your blood from damage by free radicals - a first step in the development of atherosclerosis. In a randomized, crossover study involving 27 healthy subjects (14 women, 13 men), eating freshly chopped chili was found to increase the resistance of blood fats, such as cholesterol and triglycerides, to oxidation (free radical injury).

Subjects were randomly divided into 2 groups. For 4 weeks, half the subjects ate a freshly chopped chili blend (30 grams/day, about 1 ounce), consisting of 55% cayenne, while the other half consumed a bland diet (no chili). After 4 weeks, the groups were crossed over for another 4 weeks. During the intervention periods, consumption of other spices such as cinnamon, ginger, garlic, and mustard was restricted. Blood samples were obtained at the beginning of the study and after each dietary period.

After eating the chili-containing diet, the rate of oxidation (free radical damage to cholesterol and triglycerides) was significantly lower in both men and women than that seen after eating the bland diet.

In addition, after eating the chili-spiced diet, women had a longer lag time before any damage to cholesterol was seen compared to the lag time seen after eating the bland diet. In men, the chili-diet also lowered resting heart rate and increased the amount of blood reaching the heart.

Clear Congestion

Capsaicin not only reduces pain, but its peppery heat also stimulates secretions that help clear mucus from your stuffed up nose or congested lungs.

Boost Immunity

The bright color of red chili peppers signals its high content of beta-carotene or pro-vitamin A. Just two teaspoons of red chili peppers provide about 6% of the daily value for vitamin C coupled with more than 10% of the daily value for vitamin A. Often called the anti-infection vitamin, vitamin A is essential for healthy mucous membranes, which line the nasal passages, lungs, intestinal tract and urinary tract and serve as the body's first line of defense against invading pathogens.

Help Stop the Spread of Prostate Cancer

Red chili peppers' capsaicin, the compound responsible for their pungent heat, stops the spread of prostate cancer cells through a variety of mechanisms, indicates a study published in the March 15, 2006 issue of *Cancer Research* . Capsaicin triggers suicide in both primary types of prostate cancer cell lines, those whose growth is stimulated by male hormones and those not affected by them. In addition, capsaicin lessens the expression of prostate-specific antigen (PSA), inhibits the ability of the most potent form of testosterone, dihydrotestosterone, to activate PSA, and directly inhibits PSA transcription, causing PSA levels to plummet.

The dose effective for test animals was equivalent to 400 milligrams of capsaicin, three times a week, for a man weighing about 200 pounds. After four weeks of receiving capsaicin, prostate cancer tumor growth and size decreased significantly in the animals. One warning: Excessive intake of hot chilies has been linked to stomach cancer, so don't go overboard.

Prevent Stomach Ulcers

Chili peppers have a bad—and mistaken—reputation for contributing to stomach ulcers. Not only do they not cause ulcers, they can help prevent them by killing bacteria you may have ingested, while stimulating the cells lining the stomach to secrete protective buffering juices.

Lose Weight

All that heat you feel after eating hot chili peppers takes energy—and calories to produce. Even sweet red peppers have been found to contain substances that significantly increase thermogenesis (heat production) and oxygen consumption for more than 20 minutes after they are eaten.

Lower Risk of Type 2 Diabetes

Making chili pepper a frequently enjoyed spice in your Healthiest Way of Eating could help reduce your risk of hyperinsulinemia (high blood levels of insulin)—a disorder associated with type 2 diabetes.

In a study published in the July 2006 issue of the *American Journal of Clinical Nutrition*, Australian researchers show that the amount of insulin required to lower blood sugar after a meal is reduced if the meal contains chili pepper. When chili-containing meals are a regular part of the diet, insulin requirements drop even lower.

Plus, chili's beneficial effects on insulin needs get even better as body mass index (BMI, a measure of obesity) increases. In overweight people, not only do chili-containing meals significantly lower the amount of insulin required to lower blood sugar levels after a meal, but chili-containing meals also result in a lower ratio of C-peptide/ insulin, an indication that the rate at which the liver is clearing insulin has increased.

The amount of C-peptide in the blood also shows how much insulin is being produced by the pancreas. The pancreas produces proinsulin, which splits into insulin and C-peptide when secreted into the bloodstream. Each molecule of proinsulin breaks into one molecule of C-peptide and one molecule of insulin, so less C-peptide means less insulin has been secreted into the bloodstream.

In this study, which involved 36 subjects aged 22-70 years, the effects of three interventions were evaluated. Subjects were given a bland meal after a bland diet containing no spices, a chili-containing meal after a bland diet, and finally, a chili-containing meal after a chili-containing diet. A palatable chili flavoring, not pure capsaicin (the active component in chili), was used.

Blood sugar rose similarly after all three interventions, but insulin rose the most after the bland meal after a bland diet and the least after the chili-containing meal after a chili-rich diet.

The maximum increases in insulin after the bland diet followed by a chili-containing meal were 15% lower than after the bland meal following a bland diet, and 24% lower after the chili-containing meal after a chili-rich diet compared to the chili-containing meal after the bland diet.

C-peptide blood levels also increased the most after the bland meal after a bland diet and the least after the chili-containing meal after a chili-rich diet, showing the least insulin was secreted after the chili-rich diet and meal.

In addition, the C-peptide/insulin ratio was highest after the chili-containing meal after a chili-rich diet, indicating an increase in the liver's ability to clear insulin.

Besides capsaicin, chilies contain antioxidants, including vitamin C and carotenoids, which might also help improve insulin regulation.

A little chili pepper can really perk up an omelet, add heat to a black bean/sweet potato soup, or transform an ordinary salad dressing. So, spice up your meals with chili peppers. Your body will need to make less insulin and will use it more effectively. No need to go overboard though. Population studies in India and Mexico suggest that loading up on hot chilies at every meal may be linked to increased risk of stomach cancer.

Description

This is the plant that puts fire on your tongue and maybe even a tear in your eye when you eat spicy Mexican, simmering Szechuan, smoldering Indian, or torrid Thai food. Chili peppers belong to the family of foods bearing the Latin name Capsicum.

There are hundreds of different types of chili peppers that vary in size, shape, color, flavor and "hotness." This fleshy berry features many seeds inside a potent package that can range from less than one inch to six inches in length, and approximately one-half to one inch in diameter. Chili peppers are usually red or green in color.

Habanero, chipotle, jalapeno, Anaheim, and ancho are just some of the popular varieties of chili peppers available. Another is cayenne, which is well known as a spice in its dried and powdered form, and usually referred to as cayenne or cayenne pepper (even though that term does refer to the whole pepper, regardless of preparation).

Other ground chili peppers are used to make chili powder. Chili peppers are used as a food and seasoning and revered for their medicinal qualities.

History

It's not surprising that chili peppers can trace their history to Central and South America, regions whose cuisines are renowned for their hot and spicy flavors. Chili peppers have been cultivated in these regions for more than seven thousand years, first as a decorative item and later as a foodstuff and medicine.

It was not until the 15th and 16th centuries that chili peppers were introduced to the rest of the world. Christopher Columbus encountered them on his explorations of the Caribbean Islands and brought them back to Europe. There, they were used as a substitute for black pepper, which was very expensive since it had to be imported from Asia.

Explorer Ferdinand Magellan is credited with introducing chili peppers into Africa and Asia, continents that have since incorporated them into their cuisines and pharmacopeias. Chili peppers are now grown on all continents, however, China, Turkey, Nigeria, Spain and Mexico are among the largest commercial producers.

How to Select and Store

Choose fresh chili peppers that have vivid, deep colors and glossy, firm and taut skins. Their stems should seem hardy and fresh. With the exception of jalapenos, peppers should not have any cracks near the stem end. Avoid those that are wrinkled or have soft areas or black spots.

When purchasing dried chili peppers look for ones that are still vivid in color. If they've lost their color, they've probably lost their flavor as well. Both fresh and dried chili peppers are available throughout the year in most areas.

Even though dried herbs and spices are widely available in supermarkets, explore the local spice stores or ethnic markets in your area. Oftentimes, these stores feature an expansive selection of dried herbs and spices that are of superior quality and freshness than those offered in regular markets. Just like with other dried spices, try to select organically grown dried chili pepper, including cayenne pepper, since this will give you more assurance that it has not been irradiated.

Place unwashed fresh peppers in paper bags or wrap in paper towels and store in the vegetable compartment of the refrigerator, where they should keep for at least one week. Avoid storing peppers in plastic bags as this may result in moisture accumulation, which will cause them to spoil more quickly.

Fresh peppers can also be hung in the sunlight to dry. Once dried, they can be used to make freshly ground chili powder. Dried peppers and chili powders should be kept in a tightly sealed jar, away from sunlight.

Powdered chili pepper, such as cayenne pepper and chili powder, should be kept in a tightly sealed glass jar, away from direct sunlight.

How to Enjoy

A Few Quick Serving Ideas

- The next time you make healthy sautéed vegetables, add some chili peppers to turn up the spice volume.
- Add chili peppers to your favorite corn bread recipe to give it an extra spark.
- Add minced chili peppers to yogurt and use as a condiment or dip.
- Add jalapenos to your favorite tuna salad recipe.
- Purée fresh chili peppers together with olive oil, garlic, coriander, peppermint, and caraway. If you would like, add your own favorite herbs and spices to this mixture to make your own version of Harissa, a condiment popular in the some Middle Eastern and North African countries.
- Keep a container of cayenne pepper on the table right next to the pepper mill, so you and your family can add a pinch of extra spice to any of your meals.
- Cayenne pepper and lemon juice make great complements to cooked bitter greens such as collards, kale and mustard greens.

Safety

Capsaicin can irritate or burn your eyes or hands. Chili oil can stick to the skin, so wash hands thoroughly after handling the peppers and be cautious about touching your hands to your eyes. Be aware that pepper dust from grinding dried peppers can irritate throat and eyes. You can protect yourself by wearing a dust mask and goggles.

If you find you can't take the heat, cool off with a glass of milk. A protein in milk called casein can help douse capsaicin's fire.

Chili Pepper Belongs to the Nightshade Family

Chili pepper is one of the spices that belong to the nightshade (Solanaceae) family. For helpful information about nightshade vegetables—including our WHFoods Recommendations—please see our article, Which foods are classified as "nightshades," and is it true that foods from this group can potentially contain problematic substances?

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Chili Peppers, hot, dried
2.00 tsp
5.40 grams

Calories: 15
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin E	2.06 mg (ATE)	14	16.2	excellent
vitamin A	80.05 mcg RAE	9	10.5	very good
fiber	1.88 g	8	8.9	very good
vitamin B6	0.11 mg	6	7.6	very good
vitamin K	5.71 mcg	6	7.5	very good
copper	0.05 mg	6	6.6	very good
iron	0.93 mg	5	6.1	very good
manganese	0.09 mg	5	5.3	good
vitamin B3	0.63 mg	4	4.7	good
vitamin B2	0.05 mg	4	4.5	good
potassium	105.30 mg	3	3.6	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Cilantro & Coriander seeds

Like other spices coriander is available throughout the year providing a fragrant flavor that is reminiscent of both citrus peel and sage.

The fruit of the coriander plant contains two seeds which, when dried, are the portions used as the dried spice. When ripe, the seeds are yellowish-brown in color with longitudinal ridges. Coriander seeds are available whole or in ground powder form.

Cilantro, leaf, fresh
0.50 cup
(8.00 grams)

Calories: 2
GI: very low

Nutrient	DRI/DV
vitamin K	28%
vitamin C	3%
vitamin A	3%

Health Benefits

Coriander seeds have a health-supporting reputation that is high on the list of the healing spices. In parts of Europe, coriander has traditionally been referred to as an "anti-diabetic" plant. In parts of India, it has traditionally been used for its anti-inflammatory properties. In the United States, coriander has recently been studied for its cholesterol-lowering effects.

Control of Blood Sugar, Cholesterol and Free Radical Production

Recent research studies (though still on animals) have confirmed all three of these healing effects. When coriander was added to the diet of diabetic mice, it helped stimulate their secretion of insulin and lowered their blood sugar. When given to rats, coriander reduced the amount of damaged fats (lipid peroxides) in their cell membranes. And when given to rats fed a high-fat, high-cholesterol diet, coriander lowered levels of total and LDL (the "bad" cholesterol), while actually increasing levels of HDL (the "good" cholesterol). Research also suggests that the volatile oils found in the leaves of the coriander plant, commonly known as cilantro, may have antimicrobial properties.

A Phytonutrient-Dense Herb

Many of the above healing properties of coriander can be attributed to its exceptional phytonutrient content. Coriander's volatile oil is rich in beneficial phytonutrients, including *carvone*, *geraniol*, *limonene*, *borneol*, *camphor*, *elemol*, and *linalool*. Coriander's flavonoids include *quercitin*, *kaempferol*, *rhamnetin*, and *epigenin*. Plus, coridander contains active phenolic acid compounds, including *caffeic* and *chlorogenic acid*.

Spice Up Your Life and Subdue the Salmonella

Coriander (also called cilantro) contains an antibacterial compound that may prove to be a safe, natural means of fighting Salmonella, a frequent and sometimes deadly cause of foodborne illness, suggests a study published in the June 2004 issue of the *Journal of Agriculture and Food Chemistry*.

Working together, U.S. and Mexican researchers isolated the compound, dodecenal, which laboratory tests showed is twice as effective as the commonly used antibiotic drug gentamicin at killing Salmonella. Since most natural antibacterial agents found in food have weak activity, study leader Isao Kubo, a chemist at the University of California, Berkeley, noted, "We were surprised that dodecenal was such a potent antibiotic."

While dodecenal is found in comparable amounts in both the seeds and fresh leaves of coriander, the leaves are usually eaten more frequently since they are one of the main ingredients in salsa, along with tomatoes, onions and green chillies.

In addition to dodecenal, eight other antibiotic compounds were isolated from fresh coriander, inspiring the food scientists to suggest that dodecenal might be developed as a tasteless food additive to prevent foodborne illness. While this may prove to be a useful idea, who wants to settle for "tasteless" food protection? Our suggestion at the World's Healthiest Foods? Enjoy more fresh salsa and other delicious recipes featuring coriander!

Description

Coriander is considered both an herb and a spice since both its leaves and its seeds are used as a seasoning condiment. Fresh coriander leaves are more commonly known as cilantro and bear a strong resemblance to Italian flat leaf parsley. This is not surprising owing to the fact that they belong to the same plant family (*Umbelliferae*).

The fruit of the coriander plant contains two seeds which, when dried, are the parts that are used as the dried spice. When ripe, the seeds are yellowish-brown in color with longitudinal ridges. They have a fragrant flavor that is reminiscent of both citrus peel and sage. Coriander seeds are available in whole or ground powder form.

The name coriander is derived from the Greek word *koris*, which means bug. It may have earned this name because of the "buggy" offensive smell that it has when unripe. The Latin name for coriander is *Coriandrum sativum*.

History

The use of coriander can be traced back to 5,000 BC, making it one of the world's oldest spices. It is native to the Mediterranean and Middle Eastern regions and has been known in Asian countries for thousands of years. Coriander was cultivated in ancient Egypt and given mention in the Old Testament. It was used as a spice in both Greek and Roman cultures, the latter using it to preserve meats and flavor breads. The early physicians, including Hippocrates, used coriander for its medicinal properties, including as an aromatic stimulant.

The Russian Federation, India, Morocco and Holland are among the countries that commercially produce coriander seeds. Coriander leaves (cilantro) are featured in the culinary traditions of Latin American, Indian and Chinese cuisine.

How to Select and Store

Fresh coriander (or cilantro) leaves should look vibrantly fresh and be deep green in color. They should be firm, crisp and free from yellow or brown spots.

Whenever possible, buy whole coriander seeds instead of coriander powder since the latter loses its flavor more quickly, and coriander seeds can be easily ground with a mortar and pestle.

Even through dried herbs and spices are widely available in supermarkets, explore the local spice stores or ethnic markets in your area. Oftentimes, these stores feature an expansive selection of dried herbs and spices that are of superior quality and freshness compared to those offered in regular markets. Just like with other dried spices, try to select organically grown dried coriander since this will give you more assurance that it has not been irradiated.

Coriander seeds and coriander powder should be kept in an opaque, tightly sealed glass container in a cool, dark and dry place. Ground coriander will keep for about four to six months, while the whole seeds will stay fresh for about one year.

Since it is highly perishable, fresh coriander should always be stored in the refrigerator. If possible, it should stored with its roots still attached by placing the roots in a glass of water and covering the leaves with a loosely fitting plastic bag. If the roots have been removed, wrap the coriander leaves in a damp cloth or paper towel and place them in a plastic bag. Whole coriander will last up to one week, while coriander leaves will last about three days.

Cilantro may also be frozen, either whole or chopped, in airtight containers, yet should not be thawed before use since it will lose much of its crisp texture. Alternatively, you can place it in ice cube trays covered with either water or stock that can be added when preparing soups or stews.

How to Enjoy

A Few Quick Serving Ideas

- In a saucepan over low heat, combine vanilla soymilk, honey, coriander and cinnamon for a delicious beverage.
- Healthy sauté spinach, fresh garlic and coriander seeds, mix in garbanzo beans, and season with ginger and cumin.
- Add coriander seeds to soups and broths.
- Use coriander seeds in the poaching liquid when preparing fish.
- Adding ground coriander to pancake and waffle mixes will give them a Middle Eastern flavor.

- Put coriander seeds in a pepper mill and keep on the dinner table so that you and your family can use them at any time.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Cilantro, leaf, fresh **0.50 cup** **8.00 grams**				**Calories: 2** **GI: very low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin K	24.80 mcg	28	269.6	excellent
vitamin A	26.99 mcg RAE	3	29.3	good
vitamin C	2.16 mg	3	28.2	good

World's Healthiest Foods Rating	**Rule**
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Cinnamon, ground

Although available throughout the year, the fragrant, sweet and warm taste of cinnamon is a perfect spice to use during the winter months.

Cinnamon has a long history both as a spice and as a medicine. It is the brown bark of the cinnamon tree, which is available in its dried tubular form known as a quill or as ground powder. The two varieties of cinnamon, Chinese and Ceylon, have similar flavor, however the cinnamon from Ceylon is slightly sweeter, more refined and more difficult to find in local markets.

Cinnamon, ground
2.00 tsp
(5.20 grams)

Calories: 13
GI: very low

Nutrient	DRI/DV
manganese	46%
fiber	11%
calcium	5%

Health Benefits

Cinnamon's unique healing abilities come from three basic types of components in the essential oils found in its bark. These oils contain active components called *cinnamaldehyde*, *cinnamyl acetate*, and *cinnamyl alcohol*, plus a wide range of other volatile substances.

Anti-Clotting Actions

Cinnamaldehyde (also called cinnamic aldehyde) has been well-researched for its effects on blood platelets. Platelets are constituents of blood that are meant to clump together under emergency circumstances (like physical injury) as a way to stop bleeding, but under normal circumstances, they can make blood flow inadequate if they clump together too much. The cinnaldehyde in cinnamon helps prevent unwanted clumping of blood platelets. (The way it accomplishes this health-protective act is by inhibiting the release of an inflammatory fatty acid called *arachidonic acid* from platelet membranes and reducing the formation of an inflammatory messaging molecule called *thromboxane A2*.) Cinnamon's ability to lower the release of arachidonic acid from cell membranes also puts it in the category of an "anti-inflammatory" food that can be helpful in lessening inflammation.

Anti-Microbial Activity

Cinnamon's essential oils also qualify it as an "anti-microbial" food, and cinnamon has been studied for its ability to help stop the growth of bacteria as well as fungi, including the commonly problematic yeast *Candida*. In laboratory tests, growth of yeasts that were resistant to the commonly used anti-fungal medication *fluconazole* was often (though not always) stopped by cinnamon extracts.

Cinnamon's antimicrobial properties are so effective that recent research demonstrates this spice can be used as an alternative to traditional food preservatives. In a study, published in the August 2003 issue of the *International Journal of Food Microbiology*, the addition of just a few drops of cinnamon essential oil to 100 ml (approximately 3 ounces) of carrot broth, which was then refrigerated, inhibited the growth of the foodborne pathogenic Bacillus cereus for at least 60 days. When the broth was refrigerated without the addition of cinnamon oil, the pathogenic B. cereus flourished despite the cold temperature. In addition, researchers noted that the addition of cinnamon not only acted as an effective preservative but improved the flavor of the broth.

Blood Sugar Control

Seasoning a high carb food with cinnamon can help lessen its impact on your blood sugar levels. Cinnamon slows the rate at which the stomach empties after meals, reducing the rise in blood sugar after eating. Researchers measured how quickly the stomach emptied after 14 healthy subjects ate 300 grams (1.2 cups) of rice pudding alone or seasoned with 6 grams (1.2 teaspoons) of cinnamon. Adding cinnamon to the rice pudding lowered the gastric emptying rate from 37% to 34.5% and significantly lessened the rise in blood sugar levels after eating. Am J Clin Nutr. 2 007 Jun;85(6):1552-6.

Cinnamon may also significantly help people with type 2 diabetes improve their ability to respond to insulin, thus normalizing their blood sugar levels. Both test tube and animal studies have shown that compounds in cinnamon not only stimulate insulin receptors, but also inhibit an enzyme that inactivates them, thus significantly increasing cells' ability to use glucose. Studies to confirm cinnamon's beneficial actions in humans are currently underway with the most recent report coming from researchers from the US Agricultural Research Service, who have shown that less than half a teaspoon per day of cinnamon reduces blood sugar levels in persons with type 2 diabetes. Their study included 60 Pakistani volunteers with type 2 diabetes who were not taking insulin. Subjects were divided into six groups. For 40 days, groups 1, 2 and 3 were given 1, 3, or 6 grams per day of cinnamon while groups 4, 5 and 6 received placebo capsules. Even the lowest amount of cinnamon, 1 gram per day (approximately 1/4 to 1/2 teaspoon), produced an approximately 20% drop in blood sugar; cholesterol and triglycerides were lowered as well. When daily cinnamon was stopped, blood sugar levels began to increase.

Test tube, animal and human studies have all recently investigated cinnamon's ability to improve insulin activity, and thus our cells' ability to absorb and use glucose from the blood.

On going *in vitro* or test tube research conducted by Richard Anderson and his colleagues at the USDA Human Nutrition Research Center is providing new understanding of the mechanisms through which cinnamon enhances insulin activity. In their latest paper, published in the *Journal of Agricultural and Food Chemistry*, Anderson et al. characterize the insulin-enhancing complexes in cinnamon—a collection of catechin/epicatechin oligomers that increase the body's insulin-dependent ability to use glucose roughly 20-fold. Some scientists had been concerned about potentially toxic effects of regularly consuming cinnamon. This new research shows that the potentially toxic compounds in cinnamon bark are found primarily in the lipid (fat) soluble fractions and are present only at very low levels in water soluble cinnamon extracts, which are the ones with the insulin-enhancing compounds.

A recent animal study demonstrating cinnamon's beneficial effects on insulin activity appeared in the December 2003 issue of *Diabetes Research and Clinical Practice*. In this study, when rats were given a daily dose of cinnamon (300 mg per kilogram of body weight) for a 3 week period, their skeletal muscle was able to absorb 17% more blood sugar per minute compared to that of control rats, which had not received cinnamon, an increase researchers attributed to cinnamon's enhancement of the muscle cells' insulin-signaling pathway.

In humans with type 2 diabetes, consuming as little as 1 gram of cinnamon per day was found to reduce blood sugar, triglycerides, LDL (bad) cholesterol, and total cholesterol, in a study published in the December 2003 issue of *Diabetes Care*. The placebo-controlled study evaluated 60 people with type 2 diabetes (30 men and 30 women ranging in age from 44 to 58 years) who were divided into 6 groups. Groups 1, 2, and 3 were given 1, 3, or 6 grams of cinnamon daily, while groups 4, 5, and 6 received 1, 3 or 6 grams of placebo. After 40 days, all three levels of cinnamon reduced blood sugar levels by 18-29%, triglycerides 23-30%, LDL cholesterol 7-27%, and total cholesterol 12-26%, while no significant changes were seen in those groups receiving placebo. The researchers' conclusion: including cinnamon in the diet of people with type 2 diabetes will reduce risk factors associated with diabetes and cardiovascular diseases.

By enhancing insulin signaling, cinnamon can prevent insulin resistance *even in animals fed a high-fructose diet*! A study published in *Hormone Metabolism Research* showed that when rats fed a high-fructose diet were also given cinnamon extract, their ability to respond to and utilize glucose (blood sugar) was improved so much that it was the same as that of rats on a normal (control) diet.

Cinnamon is so powerful an antioxidant that, when compared to six other antioxidant spices (anise, ginger, licorice, mint, nutmeg and vanilla) and the chemical food preservatives (BHA (butylated hydroxyanisole), BHT (butylated hydroxytoluene), and propyl gallate), cinnamon prevented oxidation more effectively than all the other spices (except mint) and the chemical antioxidants.

Cinnamon's Scent Boosts Brain Function

Not only does consuming cinnamon improve the body's ability to utilize blood sugar, but just smelling the wonderful odor of this sweet spice boosts brain activity!

Research led by Dr. P. Zoladz and presented April 24, 2004, at the annual meeting of the Association for Chemoreception Sciences, in Sarasota, FL, found that chewing cinnamon flavored gum or just smelling cinnamon enhanced study participants' cognitive processing. Specifically, cinnamon improved participants' scores on tasks related to attentional processes, virtual recognition memory, working memory, and visual-motor speed while working on a computer-based program. Participants were exposed to four odorant conditions: no odor, peppermint odor, jasmine, and cinnamon, with cinnamon emerging the clear winner in producing positive effects on brain function. Encouraged by the results of these studies, researchers will be evaluating cinnamon''s potential for enhancing cognition in the elderly, individuals with test-anxiety, and possibly even patients with diseases that lead to cognitive decline.

Calcium and Fiber Improve Colon Health and Protect Against Heart Disease

In addition to its unique essential oils, cinnamon is an excellent source of fiber and the trace mineral manganese while also a very good source of calcium. The combination of calcium and fiber in cinnamon is important and can be helpful for the prevention of several different conditions. Both calcium and fiber can bind to bile salts and help remove them from the body. By removing bile, fiber helps to prevent the damage that certain bile salts can cause to colon cells, thereby reducing the risk of colon cancer. In addition, when bile is removed by fiber, the body must break down cholesterol in order to make new bile. This process can help to lower high cholesterol levels, which can be helpful in preventing atherosclerosis and heart disease. For sufferers of irritable bowel syndrome, the fiber in cinnamon may also provide relief from constipation or diarrhea.

A Traditional Warming Remedy

In addition to the active components in its essential oils and its nutrient composition, cinnamon has also been valued in energy-based medical systems, such as Traditional Chinese Medicine, for its warming qualities. In these traditions, cinnamon has been used to provide relief when faced with the onset of a cold or flu, especially when mixed in a tea with some fresh ginger.

Description

Cinnamon is the brownish-reddish inner bark of the cinnamon tree, which when dried, rolls into a tubular form known as a quill. Cinnamon is available in either its whole quill form (cinnamon sticks) or as ground powder. All types of cinnamon belong to the same family of plants, called the Lauraceae family. In fact, there are more cinnamon species in this plant family (an estimated 2,000-2,500 total) than any other plant species. Other members of the Lauraceae family commonly enjoyed as foods include avocado and bay leaves.

Several species of cinnamon are often grouped together and referred to as either "cassia cinnamons" or just "cassia." From a U.S. marketplace perspective, the most important of these species is *Cinnamomum burmannii*, also referred to as either Indonesian cinnamon, Indonesian cassia, or Java cinnamon. This species is especially important because it accounts for over 90% of the cinnamon imported into the U.S. between 2008-2013. If you are consuming a cinnamon-flavored produce, it is most likely to have been flavored with this species of cinnamon. Cassia-type cinnamons include the following:

- *Cinnamomum burmannii*, commonly called Indonesian Cinnamon, Indonesian Cassia, or Java Cinnamon
- *Cinnamomum cassia*, also known as *Cinnamomum aromaticum*,and commonly called Chinese Cinnamon or Chinese Cassia
- *Cinnamomum loureiroi*, commonly called Vietnamese Cinnamon, Vietnamese Cassia,Saigon Cinnamon, or Saigon Cassia

In a different category from the cinnamon species above which are commonly referred to as the "cassia cinnamons" is another species of cinnamon long-valued in both culinary and herbal medicine traditions and often referred to either as Ceylon cinnamon or Sri Lanka Cinnamon. (Sri Lanka is an island country in the Indian Ocean, just off the southeast tip of India, and it was formerly known as Ceylon.) The science names for Ceylon Cinnamon are *Cinnamomum zeylanicum* and *Cinnamomum verum*. The word "verum" in this species name comes from the Latin word *verus* for "true," and is connected with the reason that you also hear this species of cinnamon being referred to as "true cinnamon."

History

Cinnamon is one of the oldest spices known. It was mentioned in the Bible and was used in ancient Egypt not only as a beverage flavoring and medicine, but also as an embalming agent. It was so highly treasured that it was considered more precious than gold. Around this time, cinnamon also received much attention in China, which is reflected in its mention in one of the earliest books on Chinese botanical medicine, dated around 2,700 B.C.

Cinnamon's popularity continued throughout history. It became one of the most relied upon spices in Medieval Europe. Due to its demand, cinnamon became one of the first commodities traded regularly between the Near East and Europe. Ceylon cinnamon is produced in Sri Lanka, India, Madagascar, Brazil and the Caribbean, while cassia is mainly produced in China, Vietnam and Indonesia.

How to Select and Store

Cinnamon is available in either stick or powder form. While the sticks can be stored for longer, the ground powder has a stronger flavor. If possible, smell the cinnamon to make sure that it has a sweet smell, a characteristic reflecting that it is fresh.

Oftentimes, both Ceylon cinnamon and Chinese cinnamon (cassia) are labeled as cinnamon. If you want to find the sweeter, more refined tasting Ceylon variety, you may need to shop in either a local spice store or ethnic market since this variety is generally less available. Just like with other dried spices, try to select organically grown cinnamon since this will give you more assurance that it has not been irradiated (among other potential adverse effects, irradiating cinnamon may lead to a significant decrease in its vitamin C and carotenoid content.)

Cinnamon should be kept in a tightly sealed glass container in a cool, dark and dry place. Ground cinnamon will keep for about six months, while cinnamon sticks will stay fresh for about one year stored this way. Alternatively, you can extend their shelf life by storing them in the refrigerator. To check to see if it is still fresh, smell the cinnamon. If it does not smell sweet, it is no longer fresh and should be discarded.

How to Enjoy

A Few Quick Serving Ideas

- Enjoy one of the favorite kids' classics—cinnamon toast—with a healthy twist. Drizzle flax seed oil onto whole wheat toast and then sprinkle with cinnamon and honey.
- Simmer cinnamon sticks with soymilk and honey for a deliciously warming beverage.
- Adding ground cinnamon to black beans to be used in burritos or nachos will give them a uniquely delicious taste.
- Healthy sauté lamb with eggplant, raisins and cinnamon sticks to create a Middle Eastern inspired meal.
- Add ground cinnamon when preparing curries.

For some of our favorite recipes, click Recipes.

Safety

While the level of naturally occurring coumarins in Ceylon cinnamon appears to be very small and lower than the amount that could cause health risks, the level of naturally occurring coumarins in the cassia cinnamons appears to be higher and may pose a risk to some individuals if consumed in substantial amounts on a regular basis. For more, see here.

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Cinnamon, ground **2.00 tsp** **5.20 grams**				**Calories: 13** **GI: very low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
manganese	0.91 mg	46	63.8	excellent
fiber	2.76 g	11	15.5	excellent
calcium	52.10 mg	5	7.3	very good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
	DRI/DV>=50% OR

very good	Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Cloves

Like other spices, cloves are available throughout the year. They are renowned for providing their uniquely warm, sweet and aromatic taste to ginger bread and pumpkin pie, but they can also make a wonderful addition to split pea and bean soups, baked beans and chili.

Cloves are the unopened pink flower buds of the evergreen clove tree. The buds are picked by hand when they are pink and dried until they turn brown in color. Cloves are about 1/2-inch long and 1/4-inch in diameter and with their tapered stem, they resemble tiny nails. In fact, their English name is actually derived from the Latin word clavus, which means nail. Although cloves have a very hard exterior, their flesh features an oily compound that is essential to their nutritional and flavor profile.

Cloves, ground
2.00 tsp
(4.20 grams)

Calories: 12
GI: very low

Nutrient	DRI/DV
manganese	127%
vitamin K	7%
fiber	6%
iron	3%
magnesium	3%
calcium	3%

Health Benefits

Clove contains significant amounts of an active component called *eugenol*, which has made it the subject of numerous health studies, including studies on the prevention of toxicity from environmental pollutants like carbon tetrachloride, digestive tract cancers, and joint inflammation. In the United States, eugenol extracts from clove have often been used in dentistry in conjunction with root canal therapy, temporary fillings, and general gum pain, since eugenol and other components of clove (including *beta-caryophyllene*) combine to make clove a mild anaesthetic as well as an anti-bacterial agent. For these beneficial effects, you'll also find clove oil in some over-the-counter sore throat sprays and mouth washes.

Anti-Inflammatory Activity

Eugenol, the primary component of clove's volatile oils, functions as an anti-inflammatory substance. In animal studies, the addition of clove extract to diets already high in anti-inflammatory components (like cod liver oil, with its high omega-3 fatty acid content) brings significant added benefits, and in some studies, further reduces inflammatory symptoms by another 15-30%. Clove also contains a variety of flavonoids, including *kaempferol* and *rhamnetin*, which also contribute to clove's anti-inflammatory (and antioxidant) properties.

A Nutrient-Dense Spice

Like its fellow spices, clove's unique phytonutrient components are accompanied by an incredible variety of traditionally-recognized nutrients. Using our nutrient ranking system, we determined cloves to be an excellent source of manganese, a very good source of vitamin K and dietary fiber, and a good source of iron, magnesium, and calcium.

Description

Cloves are the unopened pink flower buds of the evergreen clove tree. The buds are picked by hand when they are pink and dried until they turn brown in color. Cloves are about 1/2-inch long and 1/4-inch in diameter and with their tapered stem, they resemble tiny nails. In fact, their English name is actually derived from the Latin word *clavus*, which means nail.

Although cloves have a very hard exterior, their flesh features an oily compound that is essential to their nutritional and flavor profile. Cloves have a warm, sweet and aromatic taste that evokes the sultry tropical climates where they are grown.

The Latin name for cloves is *Eugenia caryophyllus*.

History

Cloves are native to the Moluccas, formerly known as the Spice Islands of Indonesia. They have been consumed in Asia for more than 2,000 years. Owing to their sweet and fragrant taste, Chinese courtiers dating back to 200 BC would keep them in their mouths in order to freshen their breath when addressing the emperor so as to not offend him. Arab traders brought cloves to Europe around the 4th century, although they did not come into widespread use until the Middle Ages when they became prized for their pungent flavor that served to mask the taste of poorly preserved foods. While for a long time, they were cultivated almost exclusively in Indonesia, today the leading clove-producing region is Zanzibar in Eastern Africa. In addition to these two regions, cloves are also grown commercially in the West Indies, Sri Lanka, Madagascar, India, Pemba and Brazil.

How to Select and Store

Whenever possible, buy whole cloves instead of clove powder since the latter loses its flavor more quickly. When squeezed with a fingernail, good quality cloves will release some of their oil. Alternatively, you can place a clove in a cup of water. Those of good quality will float vertically while those that are stale will either sink or float horizontally.

Even through dried herbs and spices are widely available in supermarkets, explore the local spice stores or ethnic markets in your area. Oftentimes, these stores feature an expansive selection of dried herbs and spices that are of superior quality and freshness compared to those offered in regular markets. Just like with other dried spices, try to select organically grown cloves since this will give you more assurance that the herb has not been irradiated.

Cloves should be kept in a tightly sealed glass container in a cool, dark and dry place. Ground cloves will keep for about six months, while whole cloves will stay fresh for about one year stored this way. Alternatively, you can extend their shelf life by storing them in the refrigerator.

How to Enjoy

A Few Quick Serving Ideas

- Pierce an onion with whole cloves and add to soups, broths or poaching liquids.
- Adding ground cloves and curry powder to healthy sautéed onions, garlic and tofu will give this dish an Indian-inspired zest.
- Impart a warming note to apple cider by adding ground cloves and cinnamon.
- Spice up fruit compote by adding ground cloves.
- Add clove powder, walnuts and raisins to your favorite Thanksgiving stuffing recipe.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Cloves, ground
2.00 tsp
4.20 grams

Calories: 12
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating

manganese	2.53 mg	127	197.8	excellent
vitamin K	5.96 mcg	7	10.4	very good
fiber	1.42 g	6	8.9	very good
iron	0.50 mg	3	4.3	good
magnesium	10.88 mg	3	4.3	good
calcium	26.54 mg	3	4.2	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Cumin seeds

Although the small cumin seed looks rather unassuming, its nutty peppery flavor packs a punch when it comes to adding a nutty and peppery flavor to chili and other Mexican and Tex-Mex dishes as well playing an important role in Indian and Middle Eastern cuisine where it is a key component of curry powder. Both whole and ground cumin are available year-round.

Cumin seeds resemble caraway seeds, being oblong in shape, longitudinally ridged, and yellow-brown in color. This is not surprising as both cumin and caraway, as well as parsley and dill, belong to the same plant family (Umbelliferae).

Cumin, seeds
2.00 tsp
(4.20 grams)

Calories: 16
GI: very low

Nutrient	DRI/DV
iron	16%
manganese	7%
copper	4%
calcium	4%
magnesium	4%
vitamin B1	3%
phosphorus	3%

Health Benefits

It is probably not just for taste alone that cumin has made it into the stellar ranks of Indian, Middle Eastern and Mexican cooking. This ordinary looking seed is anything but ordinary when it comes to health benefits.

Iron for Energy and Immune Function

Cumin seeds, whose scientific name is *Cuminum cyminum*, are an excellent source of iron, a mineral that plays many vital roles in the body. Iron is an integral component of hemoglobin, which transports oxygen from the lungs to all body cells, and is also part of key enzyme systems for energy production and metabolism. Additionally, iron is instrumental in keeping your immune system healthy. Iron is particularly important for menstruating women, who lose iron each month during menses. Additionally, growing children and adolescents have increased needs for iron, as do women who are pregnant or lactating.

Seeds of Good Digestion

Cumin seeds have traditionally been noted to be of benefit to the digestive system, and scientific research is beginning to bear out cumin's age-old reputation. Research has shown that cumin may stimulate the secretion of pancreatic enzymes, compounds necessary for proper digestion and nutrient assimilation.

Cancer Prevention

Cumin seeds may also have anti-carcinogenic properties. In one study, cumin was shown to protect laboratory animals from developing stomach or liver tumors. This cancer-protective effect may be due to cumin's potent free radical scavenging abilities as well as the ability it has shown to enhance the liver's detoxification enzymes. Yet, since free radical scavenging and detoxification are important considerations for the general maintenance of wellness, cumin's contribution to wellness may be even more farther reaching.

Description

Although the small cumin seed looks rather unassuming, it packs a punch when it comes to flavor, which can be described as penetrating and peppery with slight citrus overtones. Cumin's unique flavor complexity has made it an integral spice in the cuisines of Mexico, India and the Middle East.

Cumin seeds resemble caraway seeds, being oblong in shape, longitudinally ridged, and yellow-brown in color. This is not surprising as both cumin and caraway, as well as parsley and dill, belong to the same plant family (*Umbelliferae*). The scientific name for cumin is *Cuminum cyminum*.

Cumin is available both in its whole seed form and ground into a powder.

History

Cumin is native to Egypt and has been cultivated in the Middle East, India, China and Mediterranean countries for millennia. Throughout history, cumin has played an important role as a food and medicine and has been a cultural symbol with varied attributes.

Cumin was mentioned in the Bible not only as a seasoning for soup and bread, but also as a currency used to pay tithes to the priests. In ancient Egypt, cumin was not only used as a culinary spice, it was also an ingredient used to mummify pharaohs.

Cumin seeds were highly honored as a culinary seasoning in both ancient Greek and Roman kitchens. Cumin's popularity was partly due to the fact that its peppery flavor made it a viable replacement for black pepper, which was very expensive and hard to come by. Cumin was also noted for both its medicinal and cosmetic properties. Its application to induce a pallid complexion was frequently employed by many students trying to convince their teachers that they had pulled "all-nighters" studying for their classes.

Although a much prized spice, cumin became a symbol of frugality and greed in ancient Rome. Both Marcus Aurelius and Antoninus Pius, emperors with a reputation for their avarice, were given nicknames that included reference to cumin.

During the Middle Ages in Europe, cumin was one of the most common spices used. Around that time, cumin added another attribute to its repertoire—it became recognized as a symbol of love and fidelity. People carried cumin in their pockets when attending wedding ceremonies, and married soldiers were sent off to war with a loaf of cumin bread baked by their wives. Cumin's use for fortifying love is also represented in certain Arabic traditions in which a paste of ground cumin, pepper and honey is thought to have aphrodisiac properties.

While it still maintained an important role in Indian and Middle Eastern cuisines, the popularity of cumin in Europe declined after the Middle Ages. Today, cumin is experiencing renewed recognition owing to newfound appreciation of its culinary and therapeutic properties.

How to Select and Store

Whenever possible, buy whole cumin seeds instead of cumin powder since the latter loses its flavor more quickly, and the seeds can be easily ground with a mortar and pestle.

Even through dried herbs and spices are widely available in supermarkets, explore the local spice stores or ethnic markets in your area. Oftentimes, these stores feature an expansive selection of dried herbs and spices that are of superior quality and freshness compared to those offered in regular markets. Just like with other dried spices, try to select organically grown dried cumin since this will give you more assurance that it has not been irradiated.

Cumin seeds and cumin powder should be kept in a tightly sealed glass container in a cool, dark and dry place. Ground cumin will keep for about six months, while the whole seeds will stay fresh for about one year.

How to Enjoy

A Few Quick Serving Ideas:

- The combination of cumin, black pepper and honey is considered to be an aphrodisiac in certain middle Eastern countries. Whether or not this potion will actually inspire Cupid's arrows, it is certainly a tasty combination that can be used to flavor vegetables, chicken and fish dishes.
- Make a cup of warming and soothing cumin tea by boiling seeds in water and then letting them steep for 8-10 minutes.
- As the taste of cumin is a great complement to the hearty flavor of legumes such as lentils, garbanzo beans and black beans, add this spice when preparing a recipe with these foods.
- Take plain brown rice and magically give it special pizzazz by adding cumin seeds, dried apricots and almonds.
- Seasoning healthy sautéed vegetables with cumin will give them a North African flair.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Cumin, seeds
2.00 tsp
4.20 grams

Calories: 16
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
iron	2.79 mg	16	17.7	excellent
manganese	0.14 mg	7	8.0	very good
copper	0.04 mg	4	5.1	good
calcium	39.10 mg	4	4.5	good
magnesium	15.37 mg	4	4.4	good
phosphorus	20.96 mg	3	3.4	good
vitamin B1	0.03 mg	3	2.9	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Dill

Providing a tangy addition to pickles, salad dressing and fish dishes, fresh dill is available at markets during the summer and early fall while dried dill is available throughout the year.

Dill is native to southern Russia, western Africa and the Mediterranean region. The seeds are stronger and more flavorful than the leaves and are most commonly associated with the cuisines of Scandinavia and Germany. Its green leaves are wispy and fernlike and have a soft, sweet taste.

Dill, sprig, fresh
0.50 cup
(4.45 grams)

Calories: 2
GI: very low

Nutrient	DRI/DV
vitamin C	5%
manganese	3%

Health Benefits

Dill's unique health benefits come from two types of healing components: *monoterpenes*, including carvone, limonene, and anethofuran; and *flavonoids*, including kaempferol and vicenin.

Protection Against Free Radicals and Carcinogens

The monoterpene components of dill have been shown to activate the enzyme *glutathione-S-transferase*, which helps attach the anti-oxidant molecule glutathione to oxidized molecules that would otherwise do damage in the body. The activity of dill's volatile oils qualify it as a "chemoprotective" food (much like parsley) that can help neutralize particular types of carcinogens, such as the *benzopyrenes* that are part of cigarette smoke, charcoal grill smoke, and the smoke produced by trash incinerators.

An Anti-Bacterial Spice

The total volatile oil portion of dill has also been studied for its ability to prevent bacterial overgrowth. In this respect, dill shares the stage with garlic, which has also been shown to have "bacteriostatic" or bacteria-regulating effects.

A Flavorful Way to Help Prevent Bone Loss

In addition to its chemoprotective and bacteriostatic properties, our food ranking system qualified dill as a very good source of calcium. Calcium is important for reducing the bone loss that occurs after menopause and in some conditions, such as rheumatoid arthritis. Our food ranking system also qualified dill as a good source of dietary fiber and a good source of the minerals manganese, iron and magnesium.

Description

Dill is a unique plant in that both its leaves and seeds are used as a seasoning. Dill's green leaves are wispy and fernlike and have a soft, sweet taste. Dried dill seeds are light brown in color and oval in shape, featuring one flat side and one convex ridged side. The seeds are similar in taste to caraway, featuring a flavor that is aromatic, sweet and citrusy, but also slightly bitter.

Dill's name comes from the old Norse word *dilla* which means "to lull." This name reflects dill's traditional uses as both a carminative stomach soother and an insomnia reliever.

Dill is scientifically known as *Anethum graveolens* and is part of the *Umbelliferae* family, whose other members include parsley, cumin and bay.

History

Dill is native to southern Russia, western Africa and the Mediterranean region. It has been used for its culinary and medicinal properties for millennia. Dill was mentioned both in the Bible and in ancient Egyptian writings. It was popular in the ancient Greek and Roman cultures, where it was considered a sign of wealth and was revered for its many healing properties. Dill was used by Hippocrates, the father of medicine, in a recipe for cleaning the mouth. Ancient soldiers would apply burnt dill seeds to their wounds to promote healing.

The curative properties of dill have been honored throughout history. The Conqueror Charlemagne even made it available on his banquet tables, so his guests who indulged too much could benefit from its carminative properties. Today, dill is a noted herb in the cuisines of Scandinavia, Central Europe, North Africa and the Russian Federation.

How to Select and Store

Whenever possible, choose fresh dillweed over the dried form of the herb since it is superior in its delicate fragrant flavor. The leaves of fresh dill should look feathery and green in color. Dill leaves that are a little wilted are still acceptable since they usually droop very quickly after being picked.

Even through dried herbs and spices are widely available in supermarkets, explore the local spice and ethnic stores in your area. Oftentimes, these stores feature an expansive selection of dried herbs and spices that are of superior quality and freshness compared to those offered in regular markets. Just like with other dried herbs, try to select organically grown dill seeds since this will give you more assurance that the spice has not been irradiated.

Fresh dill should always be stored in the refrigerator either wrapped in a damp paper towel or with its stems placed in a container of water. Since it is very fragile, even if stored properly, dill will only keep fresh for about two days. Dill can be frozen, either whole or chopped, in airtight containers. Alternatively, you can freeze the dill leaves in ice cube trays covered with water or stock that can be added when preparing soups or stews.

Dried dill seeds should be stored in a tightly sealed glass container in a cool, dry and dark place where they will keep fresh for about six months.

How to Enjoy

A Few Quick Serving Ideas

- Combine dill weed with plain yogurt and chopped cucumber for a delicious cooling dip.
- Use dill when cooking fish, especially salmon and trout, as the flavors complement one another very well.
- Use dill weed as a garnish for sandwiches.
- Since dill seeds were traditionally used to soothe the stomach after meals, place some seeds in a small dish and place it on the dinner table for all to enjoy.
- Add dill to your favorite egg salad recipe.
- Mix together chopped potatoes, green beans, and plain yogurt, then season with both dill seeds and chopped dill weed.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Dill, sprig, fresh
0.50 cup

4.45 grams

Calories: 2
GI: very low

Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin C	3.78 mg	5	47.5	very good
manganese	0.06 mg	3	28.3	good

World's Healthiest Foods Rating	**Rule**
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Ginger

Aromatic, pungent and spicy, ginger adds a special flavor and zest to Asian stir fries and many fruit and vegetable dishes. Fresh ginger root is available year round in the produce section of your local market.

Ginger is the underground rhizome of the ginger plant with a firm, striated texture. The flesh of the ginger rhizome can be yellow, white or red in color, depending upon the variety. It is covered with a brownish skin that may either be thick or thin, depending upon whether the plant was harvested when it was mature or young.

Ginger, slices, fresh **1.00 TBS** **(6.00 grams)**	**Calories: 5** **GI: very low**
Nutrient	**DRI/DV**

Health Benefits

Historically, ginger has a long tradition of being very effective in alleviating symptoms of gastrointestinal distress. In herbal medicine, ginger is regarded as an excellent *carminative* (a substance which promotes the elimination of intestinal gas) and *intestinal spasmolytic* (a substance which relaxes and soothes the intestinal tract). Modern scientific research has revealed that ginger possesses numerous therapeutic properties including antioxidant effects, an ability to inhibit the formation of inflammatory compounds, and direct anti-inflammatory effects.

Gastrointestinal Relief

A clue to ginger's success in eliminating gastrointestinal distress is offered by recent double-blind studies, which have demonstrated that ginger is very effective in preventing the symptoms of motion sickness, especially seasickness. In fact, in one study, ginger was shown to be far superior to Dramamine, a commonly used over-the-counter and prescription drug for motion sickness. Ginger reduces all symptoms associated with motion sickness including dizziness, nausea, vomiting, and cold sweating.

Safe and Effective Relief of Nausea and Vomiting During Pregnancy

Ginger's anti-vomiting action has been shown to be very useful in reducing the nausea and vomiting of pregnancy, even the most severe form, *hyperemesis gravidum*, a condition which usually requires hospitalization. In a double-blind trial, ginger root brought about a significant reduction in both the severity of nausea and number of attacks of vomiting in 19 of 27 women in early pregnancy (less than 20 weeks). Unlike antivomiting drugs, which can cause severe birth defects, ginger is extremely safe, and only a small dose is required.

A review of six double-blind, randomized controlled trials with a total of 675 participants, published in the April 2005 issue of the journal, *Obstetrics and Gynecology*,has confirmed that ginger is effective in relieving the severity of nausea and vomiting during pregnancy. The review also confirmed the absence of significant side effects or adverse effects on pregnancy outcomes.

Anti-Inflammatory Effects

Ginger contains very potent anti-inflammatory compounds called *gingerols*. These substances are believed to explain why so many people with osteoarthritis or rheumatoid arthritis experience reductions in their pain levels and improvements in their mobility when they consume ginger regularly. In two clinical studies involving patients who responded to conventional drugs and those who didn't, physicians found that 75% of arthritis patients and 100% of patients with muscular discomfort experienced relief of pain and/or swelling.

Arthritis-related problems with your aging knees? Regularly spicing up your meals with fresh ginger may help, suggests a study published in a recent issue of *Osteoarthritis Cartilage*. In this twelve month study, 29 patients with painful arthritis in the knee (6 men and 23 women ranging in age from 42-85 years) participated in a placebo-controlled, double-blind, crossover study. Patients switched from placebo to ginger or visa versa after 3 months. After six months, the double-blind code was broken and twenty of the patients who wished to continue were followed for an additional six months.

By the end of the first six month period, those given ginger were experiencing significantly less pain on movement and handicap than those given placebo. Pain on movement decreased from a score of 76.14 at baseline to 41.00, while handicap decreased from 73.47 to 46.08. In contrast, those who were switched from ginger to placebo experienced an increase in pain of movement (up to 82.10) and handicap (up to 80.80) from baseline. In the final phase of the study when all patients were getting ginger, pain remained low in those already taking ginger in phase 2, and decreased again in the group that had been on placebo.

Not only did participants' subjective experiences of pain lessen, but swelling in their knees, an objective measurement of lessened inflammation, dropped significantly in those treated with ginger. The mean target knee circumference in those taking ginger dropped from 43.25cm when the study began to 39.36cm by the 12th week. When this group was switched to placebo in the second phase of the study, their knee circumferences increased, while those who had been on placebo but were now switched to ginger experienced a decrease in knee circumference. In the final phase, when both groups were given ginger, mean knee circumference continued to drop, reaching lows of 38.78 and 36.38 in the two groups.

How does ginger work its anti-inflammatory magic? Two other recent studies provide possible reasons.

A study published in the November 2003 issue of *Life Sciences* suggests that at least one reason for ginger's beneficial effects is the free radical protection afforded by one of its active phenolic constituents, 6-gingerol. In this *in vitro* (test tube) study, 6-gingerol was shown to significantly inhibit the production of nitric oxide, a highly reactive nitrogen molecule that quickly forms a very damaging free radical called peroxynitrite. Another study appearing in the November 2003 issue of *Radiation Research* found that in mice, five days treatment with ginger (10 mg per kilogram of body weight) prior to exposure to radiation not only prevented an increase in free radical damage to lipids (fats found in numerous bodily components from cell membranes to cholesterol), but also greatly lessened depletion of the animals' stores of glutathione, one of the body's most important internally produced antioxidants.

A study published in the February 2005 issue of the *Journal of Alternative and Complementary Medicine* sheds further light on the mechanisms of action that underlie ginger's anti-inflammatory effectiveness. In this research, ginger was shown to suppress the pro-inflammatory compounds (cytokines and chemokines) produced by synoviocytes (cells comprising the synovial lining of the joints), chrondrocytes (cells comprising joint cartilage) and leukocytes (immune cells).

Protection against Colorectal Cancer

Gingerols, the main active components in ginger and the ones responsible for its distinctive flavor, may also inhibit the growth of human colorectal cancer cells, suggests research presented at the Frontiers in Cancer Prevention Research, a major meeting of cancer experts that took place in Phoenix, AZ, October 26-30, 2003.

In this study, researchers from the University of Minnesota's Hormel Institute fed mice specially bred to lack an immune system a half milligram of (6)-gingerol three times a week before and after injecting human colorectal cancer cells into their flanks. Control mice received no (6)-gingerol.

Tumors first appeared 15 days after the mice were injected, but only 4 tumors were found in the group of -gingerol-treated mice compared to 13 in the control mice, plus the tumors in the -gingerol group were smaller on average. Even by day 38, one mouse in the (6)-gingerol group still had no measurable tumors. By day 49, all the control mice had been euthanized since their tumors had grown to one cubic centimeter (0.06 cubic inch), while tumors in 12 of the (6)-gingerol treated mice still averaged 0.5 cubic centimeter—half the maximum tumor size allowed before euthanization.

Research associate professor Ann Bode noted, "These results strongly suggest that ginger compounds may be effective chemopreventive and/or chemotherapeutic agents for colorectal carcinomas."

In this first round of experiments, mice were fed ginger before and after tumor cells were injected. In the next round, researchers will feed the mice ginger only after their tumors have grown to a certain size. This will enable them to look at the question of whether a patient could eat ginger to slow the metastasis of a nonoperable tumor. Are they optimistic? The actions of the University of Minnesota strongly suggest they are. The University has already applied for a patent on the use of (6)-gingerol as an anti-cancer agent and has licensed the technology to Pediatric Pharmaceuticals (Iselin, N.J.).

Ginger Induces Cell Death in Ovarian Cancer Cells

Lab experiments presented at the 97th Annual Meeting of the American Association for Cancer, by Dr Rebecca Lui and her colleagues from the University of Michigan, showed that gingerols, the active phytonutrients in ginger, kill ovarian cancer cells by inducing apoptosis (programmed cell death) and autophagocytosis (self-digestion).

Ginger extracts have been shown to have both antioxidant, anti-inflammatory and anti-tumor effects on cells. To investigate the latter, Dr Liu examined the effect of a whole ginger extract containing 5% gingerol on a number of different ovarian cancer cell lines.

Exposure to the ginger extract caused cell death in all the ovarian cancer lines studied.

A pro-inflammatory state is thought to be an important contributing factor in the development of ovarian cancer. In the presence of ginger, a number of key indicators of inflammation (vascular endothelial growth factor, interleukin-8 and prostaglandin E2) were also decreased in the ovarian cancer cells.

Conventional chemotherapeutic agents also suppress these inflammatory markers, but may cause cancer cells to become resistant to the action of the drugs. Liu and her colleagues believe that ginger may be of special benefit for ovarian cancer patients because cancer cells exposed to ginger do not become resistant to its cancer-destroying effects. In the case of ovarian cancer, an ounce of prevention—in the delicious form of liberal use of ginger—is an especially good idea. Ovarian cancer is often deadly since symptoms typically do not appear until late in the disease process, so by the time ovarian cancer is diagnosed, it has spread beyond the ovaries. More than 50% of women who develop ovarian cancer are diagnosed in the advanced stages of the disease.

Immune Boosting Action

Ginger can not only be warming on a cold day, but can help promote healthy sweating, which is often helpful during colds and flus. A good sweat may do a lot more than simply assist detoxification. German researchers have recently found that sweat contains a potent germ-fighting agent that may help fight off infections. Investigators have isolated the gene responsible for the compound and the protein it produces, which they have named *dermicidin*. Dermicidin is manufactured in the body's sweat glands, secreted into the sweat, and transported to the skin's surface where it provides protection against invading microorganisms, including bacteria such as *E. coli* and *Staphylococcus aureus* (a common cause of skin infections), and fungi, including *Candida albicans*.

Ginger is so concentrated with active substances, you don't have to use very much to receive its beneficial effects. For nausea, ginger tea made by steeping one or two 1/2-inch slices (one 1/2-inch slice equals 2/3 of an ounce) of fresh ginger in a cup of hot water will likely be all you need to settle your stomach. For arthritis, some people have found relief consuming as little as a 1/4-inch slice of fresh ginger cooked in food, although in the studies noted above, patients who consumed more ginger reported quicker and better relief.

Description

The spice ginger is the underground rhizome of the ginger plant, known botanically as *Zingiber officinale*. The plant's botanical name is thought to be derived from its Sanskrit name *singabera* which means "horn shaped," a physical characteristic that ginger reflects.

The flesh of the ginger rhizome can be yellow, white or red in color, depending upon the variety. It is covered with a brownish skin that may either be thick or thin, depending upon whether the plant was harvested when it was mature or young. The ginger rhizome has a firm, yet striated texture and a taste that is aromatic, pungent and hot.

History

Native to southeastern Asia, a region whose cuisines still feature this wonderfully spicy herb, ginger has been renowned for millennia in many areas throughout the world. Ginger is mentioned in ancient Chinese, Indian and Middle Eastern writings, and has long been prized for its aromatic, culinary and medicinal properties. After the ancient Romans imported ginger from China almost two thousand years ago, its popularity in Europe remained centered in the Mediterranean region until the Middle Ages when its use spread throughout other countries. Although it was a very expensive spice, owing to the fact that it had to be imported from Asia, it was still in great demand. In an attempt to make it more available, Spanish explorers introduced ginger to the West Indies, Mexico and South America, and in the 16th century, these areas began exporting the precious herb back to Europe.

Today, the top commercial producers of ginger include Jamaica, India, Fiji, Indonesia and Australia.

How to Select and Store

Whenever possible, choose fresh ginger over the dried form of the spice since it is not only superior in flavor but contains higher levels of gingerol as well as ginger's active protease (it's anti-inflammatory compound). Fresh ginger root is sold in the produce section of markets. When purchasing fresh ginger root, make sure it is firm, smooth and free of mold. Ginger is generally available in two forms, either young or mature. Mature ginger, the more widely available type, has a tough skin that requires peeling while young ginger, usually only available in Asian markets, does not need to be peeled.

Even through dried herbs and spices like ginger powder are widely available in supermarkets, you may want to explore the local spice stores in your area. Oftentimes, these stores feature an expansive selection of dried herbs and spices that are of superior quality and freshness than those offered in regular markets. Just like with other dried spices, when purchasing dried ginger powder try to select organically grown ginger since this will give you more assurance that it has not been irradiated.

Ginger is also available in several other forms including crystallized, candied and pickled ginger.

Fresh ginger can be stored in the refrigerator for up to three weeks if it is left unpeeled. Stored unpeeled in the freezer, it will keep for up to six months.

Dried ginger powder should be kept in a tightly sealed glass container in a cool, dark and dry place. Alternatively, you can store it in the refrigerator where it will enjoy an extended shelf life of about one year.

How to Enjoy

A Few Quick Serving Ideas

- Turn up the heat while cooling off by making ginger lemonade. Simply combine freshly grated ginger, lemon juice, cane juice or honey and water.
- Add extra inspiration to your rice side dishes by sprinkling grated ginger, sesame seeds and nori strips on top.
- Combine ginger, soy sauce, olive oil and garlic to make a wonderful salad dressing.
- Add ginger and orange juice to puréed sweet potatoes.
- Add grated ginger to your favorite stuffing for baked apples.
- Spice up your healthy sautéed vegetables by adding freshly minced ginger.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Ginger, slices, fresh 1.00 TBS 6.00 grams				**Calories: 5 GI: very low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%

good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Mustard seeds

Mustard Seeds, yellow, ground
2.00 tsp
(4.00 grams)

Calories: 20
GI: very low

Nutrient	DRI/DV
selenium	15%
omega-3 fats	6%
phosphorus	5%
manganese	5%
magnesium	4%
vitamin B1	3%
copper	3%

Health Benefits

The unique healing properties of mustard seeds can partly be attributed to their home among the *Brassica* foods found in the cruciferous plant family.

Phytonutrient Compounds Protective Against Gastrointestinal Cancer

Like other *Brassicas*, mustard seeds contain plentiful amounts of phytonutrients called *glucosinolates*. The seeds also contain *myrosinase enzymes* that can break apart the glucosinolates into other phytonutrients called *isothiocyanates*. The isothiocyanates in mustard seed (and other *Brassicas*) have been repeatedly studied for their anti-cancer effects. In animal studies—and particularly in studies involving the gastrointestinal tract and colorectal cancer—intake of isothiocyanates has been shown to inhibit growth of existing cancer cells and to be protective against the formation of such cells.

Anti-Inflammatory Effects from Selenium and Magnesium

Mustard seeds emerged from our food ranking system as an excellent source of selenium, a nutrient which that has been shown to help reduce the severity of asthma, decrease some of the symptoms of rheumatoid arthritis, and help prevent cancer. They also qualified as a good source of magnesium. Like selenium, magnesium has been shown to help reduce the severity of asthma, to lower high blood pressure, to restore normal sleep patterns in women having difficulty with the symptoms of menopause, to reduce the frequency of migraine attacks, and to prevent heart attack in patients suffering from atherosclerosis or diabetic heart disease.

Mustard seeds also qualified as a very good source of omega-3 fatty acids and manganese as well as a good source of phosphorus, copper, and vitamin B1.

Description

If you are like most people, the word "mustard" probably conjures up images of ballparks and barbeques. Yet, once you add mustard seeds to your spice cabinet, the word will take on a whole new meaning, as you will also relish the spicy, aromatic rustic taste and fragrance that mustard can add to your meals.

Mustard seeds are from the mustard plant, which is a cruciferous vegetable related to broccoli, Brussels sprouts and cabbage. While there are approximately forty different varieties of mustard plants, there are three principal types used to make mustard seeds: black mustard (*Brassica nigra*), white mustard (*Brassica alba*) and brown mustard (*Brassica juncea*). Black mustard seeds have the most pungent taste, while white mustard seeds, which are actually yellow in color, are the most mild and are the ones used to make American yellow mustard. Brown mustard, which is actually dark yellow in color, has a pungent acrid taste and is the type used to make Dijon mustard.

Mustard seeds are sold either whole or as a ground powder.

History

Mustard seeds can be traced to different areas of Europe and Asia with the white variety originating in the eastern Mediterranean regions, the brown from the foothills of the Himalayan Mountains, and the black from the Middle East. Mustard seeds are mentioned in ancient Sanskrit writings dating back about 5,000 years ago. They are also mentioned in the New Testament in which the kingdom of Heaven is compared to a grain of mustard seed.

While mustard seeds were used for their culinary properties in ancient Greece, it seems that it was the ancient Romans who invented a paste from the ground seeds, which was probably the ancestor of our modern day mustard condiment. The physicians of both civilizations, including the father of medicine Hippocrates, used mustard seed medicinally.

Mustard seed is one of the most popular spices traded in the world today. As it grows well in temperate climates, the areas that produce the greatest amount of mustard seeds currently include Hungary, Great Britain, India, Canada and the United States.

How to Select and Store

Even through dried herbs and spices are widely available in supermarkets, explore the local spice stores in your area. Oftentimes, these stores feature an expansive selection of dried herbs and spices that are of superior quality and freshness compared to those offered in regular markets. Just like with other dried spices, try to select organically grown mustard seeds or powder since this will give you more assurance that the herbs have not been irradiated.

Mustard powder and mustard seeds should be kept in a tightly sealed container in a cool, dark and dry place. Prepared mustard and mustard oil should both be refrigerated.

How to Enjoy

A Few Quick Serving Ideas

Dredge chicken breast in prepared mustard and whole mustard seeds and bake.

Add some Dijon mustard to your favorite vinaigrette dressing.

Make a delicious cold millet salad by combining the cooked and cooled grain with chopped scallions, baked tofu cubes, garden peas and mustard seeds. Dress with lemon juice and olive oil.

Marinate salmon fillets in a combination of Dijon mustard and white wine.

Combine prepared mustard with honey and the seasonings of your choice to make a pungently sweet dipping sauce.

Add a collage of taste and color to rice by sprinkling some brown, black and white mustard seeds on top.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

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Mustard Seeds, yellow, ground
2.00 tsp
4.00 grams

Calories: 20
GI: very low

	DRI/DV	Nutrient	World's Healthiest

Nutrient	Amount	(%)	Density	Foods Rating
selenium	8.32 mcg	15	13.4	excellent
omega-3 fats	0.15 g	6	5.5	very good
manganese	0.10 mg	5	4.4	very good
phosphorus	33.12 mg	5	4.2	good
magnesium	14.80 mg	4	3.3	good
copper	0.03 mg	3	3.0	good
vitamin B1	0.03 mg	3	2.2	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Oregano

The warm, balsamic and aromatic flavor of oregano makes it the perfect addition to Mediterranean and Mexican cuisines. This popular herb whose name means "mountain joy" is available throughout the year.

Oregano is known botanically as Origanum vulgare and is called wild marjoram in many parts of Europe since it is closely related to the herb that we know as sweet marjoram. It is a small shrub with multi-branched stems covered with small grayish-green oval leaves and small white or pink flowers. In Mediterranean climates oregano grows as a perennial plant, but in the harsher climates of North America, they grow as annuals.

Oregano, leaf, dried
2.00 tsp
(2.00 grams)

Calories: 5
GI: very low

Nutrient	DRI/DV
vitamin K	14%
manganese	5%
iron	4%
calcium	3%
fiber	3%

Health Benefits

You may have seen a bottle marked "oil of oregano" in a health food store. There are good reasons why!

An Effective Anti-Bacterial

The volatile oils in this spice include *thymol* and *carvacrol*, both of which have been shown to inhibit the growth of bacteria, including *Pseudomonas aeruginosa* and *Staphylococcus aureus* . In Mexico, researchers have compared oregano to tinidazol, a commonly used prescription drug to treat infection from the amoeba *Giardia lamblia*. These researchers found oregano to be more effective against *Giardia* than the commonly used prescription drug.

Potent Anti-Oxidant Activity

Oregano contains numerous phytonutrients—including *thymol* and *rosmarinic acid*—that have also been shown to function as potent antioxidants that can prevent oxygen-based damage to cell structures throughout the body. In laboratory studies, oregano has demonstrated stronger anti-oxidant capacity than either of the two synthetic anti-oxidants commonly added to processed food—BHT (butylated hydroxytoluene) and BHA (butylated bydroxyanisole). Additionally, on a per gram fresh weight basis, oregano has demonstrated 42 times more antioxidant activity than apples, 30 times more than potatoes, 12 times more than oranges and 4 times more than blueberries.

A Nutrient-Dense Spice

Our food ranking system qualified oregano as a good source of fiber. Fiber works in the body to bind to bile salts and cancer-causing toxins in the colon and remove them from the body. This forces the body to break down cholesterol to make more bile salts. These are just some of the reasons that diets high in fiber have been shown to lower high cholesterol levels and reduce the risk of colon cancer.

Oregano also emerged from our food ranking system as a bountiful source of many nutrients. It qualified within our system as an excellent source of vitamin K, a very good source of manganese, and a good source of iron and calcium.

Description

While many people think of pizza when they think of oregano, this wonderful herb can add a warm, balsamic and aromatic flavor to many different dishes, especially those of the Mediterranean cuisine.

Oregano is known botanically as *Origanum vulgare* and is called wild marjoram in many parts of Europe since it is closely related to the herb that we know as sweet marjoram. Its name is derived from the Greek words *oros* (mountain) and *ganos* (joy) since not only was it a symbol of happiness, but it made the hillsides on which it grew look beautiful.

History

Oregano is native to northern Europe, although it grows throughout many regions of the world. It has been recognized for its aromatic properties since ancient times, with the Greeks and Romans holding oregano as a symbol of joy and happiness. In fact, it was a tradition for Greek and Roman brides and grooms to be crowned with a laurel of oregano.

Oregano has been cultivated in France since the Middle Ages and has come to be an important herb in Mediterranean cooking. Oregano was hardly known in the United States until the early 20th century when GIs returning from Italy brought word of this fragrant and delicious herb back to the United States.

How to Select and Store

Whenever possible, choose fresh oregano over the dried form of the herb since it is superior in flavor. The leaves of fresh oregano should look fresh and be a vibrant green in color, while the stems should be firm. They should be free from darks spots or yellowing.

Even through dried herbs and spices like oregano are widely available in supermarkets, you may want to explore the local spice stores in your area. Oftentimes, these stores feature an expansive selection of dried herbs and spices that are of superior quality and freshness compared to those offered in regular markets. Just like with other dried herbs, when purchasing dried oregano, try to buy that which has been organically grown since this will give you more assurance that it has not been irradiated.

Fresh oregano should be stored in the refrigerator wrapped in a slightly damp paper towel. It may also be frozen, either whole or chopped, in airtight containers. Alternatively, you can freeze the oregano in ice cube trays covered with either water or stock that can be added when preparing soups or stews. Dried oregano should be kept in a tightly sealed glass container in a cool, dark and dry place where it will keep fresh for about six months.

How to Enjoy

A Few Quick Serving Ideas

- Next time you enjoy a slice of pizza, garnish it with some fresh oregano.
- Oregano goes great with healthy sautéed mushrooms and onions.
- Adding a few sprigs of fresh oregano to a container of olive oil will infuse the oil with the essence of the herb.
- Fresh oregano makes an aromatic addition to omelets and frittatas.
- Sprinkle some chopped oregano onto homemade garlic bread.
- Add oregano to salad dressings.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

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Oregano, leaf, dried **2.00 tsp** **2.00 grams**				**Calories: 5** **GI: very low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
vitamin K	12.43 mcg	14	46.9	excellent
manganese	0.10 mg	5	17.0	very good
iron	0.74 mg	4	14.0	good
fiber	0.85 g	3	11.5	good
calcium	31.94 mg	3	10.8	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Parsley

The delicious and vibrant taste and wonderful healing properties of parsley are often ignored in its popular role as a table garnish. Highly nutritious, parsley can be found year round in your local supermarket.

Parsley is the world's most popular herb. It derives its name from the Greek word meaning "rock celery" (parsley is a relative to celery). It is a biennial plant that will return to the garden year after year once it is established.

Parsley, chopped, fresh
0.50 cup
(30.40 grams)

Calories: 11
GI: very low

Nutrient	DRI/DV
vitamin K	554%
vitamin C	54%
vitamin A	14%
folate	12%
iron	10%
copper	6%
potassium	5%
magnesium	4%
fiber	4%
calcium	4%
manganese	3%
phosphorus	3%
zinc	3%
vitamin B3	3%
vitamin B1	3%

Health Benefits

A sprig of parsley can provide much more than a decoration on your plate. Parsley contains two types of unusual components that provide unique health benefits. The first type is volatile oil components—including *myristicin*, *limonene*, *eugenol*, and *alpha-thujene*. The second type is flavonoids—including *apiin*, *apigenin*, *crisoeriol*, and *luteolin*.

Promote Optimal Health

Parsley's volatile oils—particularly myristicin—have been shown to inhibit tumor formation in animal studies, and particularly, tumor formation in the lungs. Myristicin has also been shown to activate the enzyme *glutathione-S-transferase*, which helps attach the molecule glutathione to oxidized molecules that would otherwise do damage in the body. The activity of parsley's volatile oils qualifies it as a "chemoprotective" food, and in particular, a food that can help neutralize particular types of carcinogens (like the *benzopyrenes* that are part of cigarette smoke and charcoal grill smoke).

A Rich Source of Anti-Oxidant Nutrients

The flavonoids in parsley—especially luteolin—have been shown to function as antioxidants that combine with highly reactive oxygen-containing molecules (called oxygen radicals) and help prevent oxygen-based damage to cells. In addition, extracts from parsley have been used in animal studies to help increase the antioxidant capacity of the blood.

In addition to its volatile oils and flavonoids, parsley is an excellent source of vitamin C and a good source of vitamin A (notably through its concentration of the pro-vitamin A carotenoid, beta-carotene).

Vitamin C has many different functions. It is the body's primary water-soluble antioxidant, rendering harmless otherwise dangerous free radicals in all water-soluble areas of the body. High levels of free radicals contribute to the development and progression of a wide variety of diseases, including atherosclerosis, colon cancer, diabetes, and asthma. This may explain why people who consume healthy amounts of vitamin C-containing foods have reduced risks for all these conditions. Vitamin C is also a powerful anti-inflammatory agent, which explains its usefulness in conditions such as osteoarthritis and rheumatoid arthritis. And since vitamin C is needed for the healthy function of the immune system, it can also be helpful for preventing recurrent ear infections or colds.

Beta-carotene, another important antioxidant, works in the fat-soluble areas of the body. Diets with beta-carotene-rich foods are also associated with a reduced risk for the development and progression of conditions like atherosclerosis, diabetes, and colon cancer. Like vitamin C, beta-carotene may also be helpful in reducing the severity of asthma, osteoarthritis, and rheumatoid arthritis. And beta-carotene is converted by the body to vitamin A, a nutrient so important to a strong immune system that its nickname is the "anti-infective vitamin."

Parsley for a Healthy Heart

Parsley is a good source of folic acid, one of the most important B vitamins. While it plays numerous roles in the body, one of its most critical roles in relation to cardiovascular health is its necessary participation in the process through which the body converts *homocysteine* into benign molecules. Homocysteine is a potentially dangerous molecule that, at high levels, can directly damage blood vessels, and high levels of homocysteine are associated with a significantly increased risk of heart attack and stroke in people with atherosclerosis or diabetic heart disease. Enjoying foods rich in folic acid, like parsley, is an especially good idea for individuals who either have, or wish to prevent, these diseases. Folic acid is also a critical nutrient for proper cell division and is therefore vitally important for cancer-prevention in two areas of the body that contain rapidly dividing cells—the colon, and in women, the cervix.

Protection against Rheumatoid Arthritis

While one study suggests that high doses of supplemental vitamin C makes osteoarthritis, a type of degenerative arthritis that occurs with aging, worse in laboratory animals, another indicates that vitamin C-rich foods, such as parsley, provide humans with protection against inflammatory polyarthritis, a form of rheumatoid arthritis involving two or more joints.

The findings, presented in the *Annals of the Rheumatic Diseases* were drawn from a study of more than 20,000 subjects who kept diet diaries and were arthritis-free when the study began, and focused on subjects who developed inflammatory polyarthritis and similar subjects who remained arthritis-free during the follow-up period. Subjects who consumed the lowest amounts of vitamin C-rich foods were more than three times more likely to develop arthritis than those who consumed the highest amounts.

So, next time parsley appears on your plate as a garnish, recognize its true worth and partake of its abilities to improve your health. As an added bonus, you'll also enjoy parsley's legendary ability to cleanse your palate and your breath at the end of your meal.

Description

While parsley is a wonderfully nutritious and healing food, it is often under-appreciated. Most people do not realize that this vegetable has more uses than just being a decorative garnish that accompanies restaurant meals. They do not know that parsley is actually a storehouse of nutrients and that it features a delicious green and vibrant taste.

The two most popular types of parsley are curly parsley and Italian flat leaf parsley. The Italian variety has a more fragrant and less bitter taste than the curly variety. There is also another type of parsley known as turnip-rooted (or Hamburg) that is cultivated for its roots, which resemble salsify and burdock. Parsley belongs to the *Umbelliferae* family of plants, and its Latin name is *Petroselinum crispum*.

History

Parsley is native to the Mediterranean region of Southern Europe. While it has been cultivated for more than 2,000 years, parsley was used medicinally prior to being consumed as a food. The ancient Greeks held parsley to be sacred, using it to not only adorn victors of athletic contests, but also for decorating the tombs of the deceased. The practice of using parsley as a garnish actually has a long history that can be traced back to the civilization of the ancient Romans.

While it is uncertain when parsley began to be consumed as a seasoning, it seems to be sometime in the Middle Ages in Europe. Some historians credit Charlemagne with its popularization since he had it grown on his estates.

In some countries, the curly leaf variety is more popular. This may have its roots in the ancient preference for this type since people were oftentimes reticent to consume the flat leaf variety because it resembled fool's parsley, a poisonous weed.

Turnip-rooted (or Hamburg) parsley, a relatively new species, having only been developed within the past two hundred years, has only recently begun gaining popularity.

How to Select and Store

Whenever possible, choose fresh parsley over the dried form of the herb since it is superior in flavor. Choose fresh parsley that is deep green in color and looks fresh and crisp. Avoid bunches that have leaves that are wilted or yellow as this indicates that they are either overmature or damaged. Just like with other dried herbs, if you choose to purchase dried parsley flakes, try to select organically grown parsley since this will give you more assurance that the herbs have not been irradiated.

Fresh parsley should be kept in the refrigerator in a plastic bag. If the parsley is slightly wilted, either sprinkle it lightly with some water or wash it without completely drying it before storing in the refrigerator.

If you have excess flat leaf parsley, you can easily dry it by laying it out in a single layer on a clean kitchen cloth. Once dried, it should be kept in a tightly sealed container in a cool, dark and dry place. Curly leaf parsley is best preserved by freezing, as opposed to drying. Although it will retain most of its flavor, it has a tendency to lose its crispness, so it is best used in recipes without first thawing.

How to Enjoy

A Few Quick Serving Ideas

- Combine chopped parsley with bulgur wheat, chopped green onions (scallions), mint leaves, lemon juice and olive oil to make the Middle Eastern classic dish, tabouli.
- Add parsley to pesto sauce to add more texture to its green color.
- Combine chopped parsley, garlic and lemon zest, and use it as a rub for chicken, lamb and beef.
- Use parsley in soups and tomato sauces.
- Serve a colorful salad of fennel, orange, cherry tomatoes, pumpkin seeds and parsley leaves.
- Chopped parsley can be sprinkled on a host of different recipes, including salads, vegetable sautés and grilled fish.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Parsley, chopped, fresh
0.50 cup
30.40 grams

Calories: 11
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin K	498.56 mcg	554	911.4	excellent
vitamin C	40.43 mg	54	88.7	excellent
vitamin A	128.04 mcg RAE	14	23.4	excellent
folate	46.21 mcg	12	19.0	excellent
iron	1.88 mg	10	17.2	excellent
copper	0.05 mg	6	9.1	very good

potassium	168.42 mg	5	7.9	good
calcium	41.95 mg	4	6.9	good
fiber	1.00 g	4	6.6	good
magnesium	15.20 mg	4	6.3	good
zinc	0.33 mg	3	4.9	good
phosphorus	17.63 mg	3	4.1	good
vitamin B3	0.40 mg	3	4.1	good
vitamin B1	0.03 mg	3	4.1	good
manganese	0.05 mg	3	4.1	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Peppermint

While peppermint leaves are available throughout the year, they are especially good in warm weather when they can give a burst of cool flavor to a summery salad or beverage.

Peppermint has greenish-purple lance-shaped leaves while the rounder leaves of spearmint are more of a grayish green color. The taste of both peppermint and spearmint bear a flavor that can be described as a cross between pepper and chlorophyll, with peppermint being a bit stronger and spearmint being a little more cool and subtle.

Peppermint, leaves, fresh
2.00 TBS
(7.60 grams)

Calories: 5
GI: very low

Nutrient	DRI/DV
manganese	5%
copper	3%
vitamin C	3%

Health Benefits

Soothe Your Tummy with Peppermint

In the world of health research, randomized controlled trials have repeatedly shown the ability of peppermint oil to relieve symptoms of irritable bowel syndrome, including indigestion, dyspepsia, and colonic muscle spasms. These healing properties of peppermint are apparently related to its smooth muscle relaxing ability. Once the smooth muscles surrounding the intestine are relaxed, there is less chance of spasm and the indigestion that can accompany it. The menthol contained in peppermint may be a key reason for this bowel-comforting effect.

A Potential Anti-Cancer Agent

Interest in peppermint has extended well beyond the digestive tract, however. *Perillyl alcohol* is a phytonutrient called a *monoterpene*, and it is plentiful in peppermint oil. In animal studies, this phytonutrient has been shown to stop the growth of pancreatic, mammary, and liver tumors. It has also been shown to protect against cancer formation in the colon, skin, and lungs. These animal-based studies have yet to be matched by equally sound human studies, however.

An Anti-Microbial Oil

Esssential oil of peppermint also stops the growth of many different bacteria. These bacteria include *Helicobacter pylori*, *Salmonella enteritidis*, *Escherichia coli O157:H7*, and *methicillin-resistant Staphylococcus aureus* (MRSA). It has also be found to inhibit the growth of certain types of fungus as well.

Breathe Easier with Peppermint

Peppermint contains the substance *rosmarinic acid*, which has several actions that are beneficial in asthma. In addition to its antioxidant abilities to neutralize free radicals, *rosmarinic acid* has been shown to block the production of pro-inflammatory chemicals, such as *leukotrienes*. It also encourages cells to make substances called *prostacyclins* that keep the airways open for easy breathing. Extracts of peppermint have also been shown to help relieve the nasal symptoms of allergic rhinitis (colds related to allergy).

A Rich Source of Traditional Nutrients

Our food ranking system also showed peppermint to deliver a wide range of traditional nutrients. Peppermint is a good source of manganese, copper, and vitamin C. Vitamin C seems to play a role in decreasing colorectal cancer risk. It is the main water-soluble antioxidant in the body is needed to decrease levels of free radicals that can cause damage to cells. Some studies have shown a link between increased vitamin C intake and a decreased risk for colon cancer, possibly by as much as 40%, while other studies have shown that vitamin C intake can help to decrease the incidence of colon tumors.

Description

Mint is the glorious plant that gives the candy of the same name its cool burst of flavor. While there are about 25 different species of mints, peppermint is actually a natural hybrid cross between *Mentha aquatica* (water mint) and *Mentha spicata* (spearmint). Peppermint has greenish-purple lance-shaped leaves while the rounder leaves of spearmint are more of a grayish green color.

The taste of both peppermint and spearmint bear a flavor that can be described as a cross between pepper and chlorophyll, with peppermint being a bit stronger and spearmint being a little more cool and subtle. In addition to peppermint and spearmint, other plants in the *Mentha* genus include apple mint, orange mint, water mint, curly mint and Corsican mint.

History

Mint is an ancient herb used since antiquity for its culinary, medicinal and aromatic properties. The origins of mint are honored in a Greek myth that tells the tale that the plant was originally a nymph (Minthe), who was transformed into a plant by Persephone, who was jealous of the affections that her husband Pluto was showing to Minthe. While Pluto could not reverse the spell that his wife cast, he did impart Minthe with a sweet smell, so when she was walked upon in the garden, her aroma would be delightful to the senses.

Mint's characteristic smell has made it one of the more popular perfuming herbs throughout history. Around the globe, from Europe to India to the Middle East, mint has been used a strewing herb to clear the air in both temples and homes. Mint has also come to symbolize hospitality in many cultures. In ancient Greece, mint leaves were rubbed on dining tables to welcome guests, while in the Middle East, the host still traditionally offers mint tea to guests upon their arrival.

Mint has played an important role in the American tradition. While the Native Americans were using mint even before the arrival of the European settlers, the early colonists brought this prized herb with them from the Old World since they had long honored it for its therapeutic properties, as well as for the delicious hot tea beverage made from its leaves.

How to Select and Store

Whenever possible, choose fresh mint over the dried form of the herb since it is superior in flavor. The leaves of fresh mint should look vibrant and be a rich green color. They should be free from dark spots or yellowing.

Even through dried herbs and spices like mint are widely available in supermarkets, you may want to explore the local spice stores in your area. Oftentimes, these stores feature an expansive selection of dried herbs and spices that are of superior quality and freshness compared to those offered in regular markets. Just like with other dried herbs, when purchasing dried mint try to select organically grown mint since this will give you more assurance that it has not been irradiated.

To store fresh mint leaves, carefully wrap them in a damp paper towel and place inside of a loosely closed plastic bag. Store in the refrigerator, where it should keep fresh for several days. Dried mint should be kept in a tightly sealed glass container in a cool, dark and dry place, where it will keep fresh for about nine to twelve months.

How to Enjoy

A Few Quick Serving Ideas

- A cup of fresh mint tea can help to soothe your stomach and your nerves.
- Toss cubes of cooked eggplant with chopped mint leaves, plain yogurt, garlic and cayenne.
- For a quick and easy salad, combine fennel, onions, oranges and mint leaves.
- Give fruit salad a unique perk by adding some fresh mint leaves to it.
- Add chopped mint leaves to gazpacho or other soups that feature tomatoes as the freshness of the mint complements the sweet acidity of tomatoes very well.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

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Peppermint, leaves, fresh
2.00 TBS
7.60 grams

Calories: 5
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
manganese	0.09 mg	5	15.2	good
copper	0.03 mg	3	11.3	good
vitamin C	2.42 mg	3	10.9	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Rosemary

Looking like a small sprig from an evergreen tree the wonderful smell and assertively pine-like fragrance and pungent flavor of rosemary goes a long way to flavor to chicken, lamb, pork, salmon and tuna dishes as well as many soups and sauces. As an evergreen, rosemary is available throughout the year.

Rosemary grows on a small evergreen shrub belonging to the Labiatae family that is related to mint. Its leaves look like flat pine-tree needles, deep green in color on top while silver-white on their underside. Its memorable flavor and unique health benefits makes it an indispensable herb for every kitchen.

Rosemary, fresh **2.00 TBS** **(4.20 grams)**	**Calories: 6** **GI: very low**
Nutrient	**DRI/DV**

Health Benefits

The wonderful smell of rosemary is often associated with good food and great times. But it could just as easily be associated with good health. Rosemary contains substances that are useful for stimulating the immune system, increasing circulation, and improving digestion. Rosemary also contains anti-inflammatory compounds that may make it useful for reducing the severity of asthma attacks. In addition, rosemary has been shown to increase the blood flow to the head and brain, improving concentration. So, the next time you enhance the flavor of some special dish with rosemary, congratulate yourself for a wise as well as delicious choice.

Description

It is not surprising that the taste and aroma of the herb rosemary, historically used for strengthening the memory, is unforgettable. Rosemary has a unique pine-like fragrant flavor that is balanced by a rich pungency, a combination that evokes both the forest and the sea. Its memorable flavor and unique health benefits makes it an indispensable herb for every kitchen.

Rosemary grows on a small evergreen shrub belonging to the *Labiatae* family that is related to mint. Its leaves look like flat pine-tree needles, deep green in color on top while silver-white on their underside.

History

Although rosemary is native to the Mediterranean, it now grows throughout much of the temperate regions in Europe and America. Rosemary has been a prized seasoning and natural medicine for millennia. Part of rosemary's popularity came from the widespread belief that rosemary stimulated and strengthened the memory, a quality for which it is still traditionally used. In ancient Greece, students would place rosemary sprigs in their hair when studying for exams, and mourners would also throw the fragrant herb into the grave of the deceased as a symbol of remembrance. In olde England, rosemary's ability to fortify the memory transformed it into a symbol of fidelity, and it played an important role in the costumes, decorations and gifts used at weddings. Rosemary oil was first extracted in the 14th century, after which it was used to make Queen of Hungary water, a very popular cosmetic used at that time. In the 16th and 17th centuries, rosemary became popular as a digestive aid in apothecaries. Recently, as modern research focuses on the beneficial active components in rosemary, our appreciation for this herb's therapeutic as well as culinary value has been renewed.

How to Select and Store

Whenever possible, choose fresh rosemary over the dried form of the herb since it is far superior in flavor. The springs of fresh rosemary should look vibrantly fresh and should be deep sage green in color, and free from yellow or dark spots.

Even through dried herbs and spices are widely available in supermarkets, explore the local spice stores in your area. Oftentimes, these stores feature an expansion selection of dried herbs and spices that are of superior quality and freshness to those offered in regular markets. Just like with other dried herbs, when purchasing dried rosemary, try to select organically grown herbs since this will give you more assurance that the herbs contain no pesticide residues and have not been irradiated (among other potential adverse effects, irradiating rosemary may lead to a significant decrease in its carotenoid content.)

Fresh rosemary should be stored in the refrigerator either in its original packaging or wrapped in a slightly damp paper towel. You can also place the rosemary sprigs in ice cube trays covered with either water or stock that can be added when preparing soups or stews. Dried rosemary should be kept in a tightly sealed container in a cool, dark and dry place where it will keep fresh for about six months.

How to Enjoy

A Few Quick Serving Ideas

- Add fresh rosemary to omelets and frittatas.
- Rosemary is a wonderful herb for seasoning chicken and lamb dishes.
- Add rosemary to tomato sauces and soups.
- Even better than butter—purée fresh rosemary leaves with olive oil and use as a dipping sauce for bread.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

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Rosemary, fresh **2.00 TBS** **4.20 grams**				**Calories: 6** **GI: very low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Sage

The soft, yet sweet savory flavor of sage along with its wonderful health-promoting properties is held in such high esteem that the International Herb Association awarded sage the title of "Herb of the Year" in 2001! Fresh, dried whole or powdered, sage is available throughout the year.

Sage leaves are grayish green in color with a silvery bloom covering. They are lance-shaped and feature prominent veins running throughout. Sage has been held in high regard throughout history both for it culinary and medicinal properties. Its reputation as a panacea is even represented in its scientific name, Salvia officinalis, derived from the Latin word, salvere, which means "to be saved."

Sage, dried
2.00 tsp
(1.40 grams)

Calories: 4
GI: very low

Nutrient	DRI/DV
vitamin K	27%

Health Benefits

Like rosemary, its sister herb in the mint (*Labitae*) family, sage contains a variety of volatile oils, flavonoids (including *apigenin*, *diosmetin*, and *luteolin*), and phenolic acids, including the phenolic acid named after rosemary—*rosmarinic acid*.

Anti-Oxidant/Anti-Inflammatory Actions

Rosmarinic acid can be readily absorbed from the GI tract, and once inside the body, acts to reduce inflammatory responses by altering the concentrations of inflammatory messaging molecules (like leukotriene B4). The rosmarinic acid in sage and rosemary also functions as an antioxidant. The leaves and stems of the sage plant also contain antioxidant enzymes, including SOD (superoxide dismutase) and peroxidase. When combined, these three components of sage—flavonoids, phenolic acids, and oxygen-handling enzymes—give it a unique capacity for stabilizing oxygen-related metabolism and preventing oxygen-based damage to the cells. Increased intake of sage as a seasoning in food is recommended for persons with inflammatory conditions (like rheumatoid arthritis),as well as bronchial asthma, and atherosclerosis. The ability of sage to protect oils from oxidation has also led some companies to experiment with sage as a natural antioxidant additive to cooking oils that can extend shelf life and help avoid rancidity.

Better Brain Function

Want some sage advice? Boost your wisdom quotient by liberally adding sage to your favorite soups, stews and casserole recipes. Research published in the June 2003 issue of *Pharmacological Biochemical Behavior* confirms what herbalists have long known: sage is an outstanding memory enhancer. In this placebo-controlled, double-blind, crossover study, two trials were conducted using a total of 45 young adult volunteers. Participants were given either placebo or a standardized essential oil extract of sage in doses ranging from 50 to 150 microls. Cognitive tests were then conducted 1, 2, 4, 5, and 6 hours afterwards. In both trials, even the 50 microl dose of sage significantly improved subjects' immediate recall.

In other research presented at the British Pharmaceutical Conference in Harrogate (September 15-17, 2003), Professor Peter Houghton from King's College provided data showing that the dried root of *Salvia miltiorrhiza*, also known as Danshen or Chinese sage, contains active compounds similar to those developed into modern drugs used to treat Alzheimer's Disease. Sage has been used in the treatment of cerebrovascular disease for over one thousand years. Four compounds isolated from an extract from the root of Chinese sage were found to be acetylcholinesterase (AChE) inhibitors. The memory loss characteristic of Alzheimer's disease is accompanied by an increase of AChE activity that leads to its depletion from both cholinergic and noncholinergic neurons of the brain. Amyloid beta-protein (A beta), the major component of amyloid plaques which form in the brain in Alzeeimer's disease, acts on the expression of AChE, and AChE activity is increased around amyloid plaques. By inhibiting this increase in AChE activity, sage provides a useful therapeutic option to the use of pharmaceutical AChE inhibitors. (October 24, 2003)

Description

You'd be a wise sage to add the herb sage to your recipes. Not only does it have a soft, yet sweet savory flavor, but for millennia, it has also been prized for its health-promoting qualities. Its reputation as a panacea is even represented in its scientific name, *Salvia officinalis*, derived from the Latin word, *salvere*, which means "to be saved."

Sage leaves are grayish green in color with a silvery bloom covering. They are lance-shaped and feature prominent veins running throughout. Sage is available fresh or dried in either whole, rubbed (lightly ground) or powder form.

History

Sage is native to countries surrounding the Mediterranean Sea and has been consumed in these regions for thousands of years. In medicinal lore, sage has one of the longest histories of use of any medicinal herb.

The Greeks and Romans were said to have highly prized the many healing properties of sage. The Romans treated it as sacred and created a special ceremony for gathering sage. Both civilizations used it as a preservative for meat, a tradition that continued until the beginning of refrigeration. What these cultures knew from experience, that sage could help to reduce spoilage, is now being confirmed by science, which has isolated the herb's numerous terpene antioxidants.

Sage's legendary status continued throughout history. Arab physicians in the 10th century believed that it promoted immortality, while 14th century Europeans used it to protect themselves from witchcraft. Sage was in so much demand in China during the 17th century, appreciated for the delicious tea beverage that it makes, that the Chinese are said to have traded three cases of tea leaves (*camellia sinensis*) to the Dutch for one case of sage leaves.

And the esteem with which sage is regarded has not faded. In 2001, the International Herb Association awarded sage the title of "Herb of the Year."

How to Select and Store

Whenever possible, choose fresh sage over the dried form of the herb since it is superior in flavor. The leaves of fresh sage should look fresh and be a vibrant green-gray in color. They should be free from darks spots or yellowing.

Even through dried herbs and spices like sage are widely available in supermarkets, you may want to explore the local spice stores in your area. Oftentimes, these stores feature an expansive selection of dried herbs and spices that are of superior quality and freshness compared to those offered in regular markets. Just like with other dried spices, when purchasing dried sage, try to select organically grown sage since this will give you more assurance that it has not been irradiated (among other potential adverse effects, irradiating sage may lead to a significant decrease in its vitamin C and carotenoid content.)

To store fresh sage leaves, carefully wrap them in a damp paper towel and place inside a loosely closed plastic bag. Store in the refrigerator where it should keep fresh for several days. Dried sage should be kept in a tightly sealed glass container in a cool, dark and dry place where it will keep fresh for about six months.

How to Enjoy

A Few Quick Serving Ideas

- Mix cooked navy beans with olive oil, sage and garlic and serve on bruschetta.
- Use sage as a seasoning for tomato sauce.
- Add fresh sage to omelets and frittatas.
- Sprinkle some sage on top of your next slice of pizza.
- Combine sage leaves, bell peppers, cucumbers and sweet onions with plain yogurt for an easy to prepare, refreshing salad.
- When baking chicken or fish in parchment paper, place some fresh sage leaves inside so that the food will absorb the flavors of this wonderful herb.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

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Sage, dried
2.00 tsp
1.40 grams

Calories: 4
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin K	24.00 mcg	27	108.8	excellent

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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Thyme

A delicate looking herb with a penetrating fragrance, thyme is a wonderful addition to bean, egg and vegetable dishes. Both fresh and dried thyme is available in your local supermarket throughout the year.

Thyme leaves are curled, elliptically shaped and very small, measuring about one-eighth of an inch long and one-sixteenth of an inch wide. The upper leaf is green-grey in color on top, while the underside is a whitish color. Along with fresh sprigs of parsley and bay leaves, thyme is included in the French combination of herbs called bouquet garni used to season stock, stews and soups.

Thyme, fresh
2.00 TBS
(4.80 grams)

Calories: 5
GI: very low

Nutrient	DRI/DV
vitamin C	10%
iron	5%
manganese	4%
fiber	3%
copper	3%

Health Benefits

Thyme has a long history of use in natural medicine in connection with chest and respiratory problems including coughs, bronchitis, and chest congestion. Only recently, however, have researchers pinpointed some of the components in thyme that bring about its healing effects. The volatile oil components of thyme are now known to include *carvacolo*, *borneol*, *geraniol*, but most importantly, *thymol*.

Significant Anti-Oxidant Protection of Cellular Membranes

Thymol—named after the herb itself—is the primary volatile oil constituent of thyme, and its health-supporting effects are well documented. In studies on aging in rats, thymol has been found to protect and significantly increase the percentage of healthy fats found in cell membranes and other cell structures. In particular, the amount of DHA (docosahexaenoic acid, an omega-3 fatty acid) in brain, kidney, and heart cell membranes was increased after dietary supplementation with thyme. In other studies looking more closely at changes in the brains cells themselves, researchers found that the maximum benefits of thyme occurred when the food was introduced very early in the lifecycle of the rats, but was less effective in offsetting the problems in brain cell aging when introduced late in the aging process.

Thyme also contains a variety of flavonoids, including *apigenin*, *naringenin*, *luteolin*, and *thymonin*. These flavonoids increase thyme's antioxidant capacity, and combined with its status as a good source of manganese, give thyme a high standing on the list of anti-oxidant foods.

Time's Up for Microbes with Thyme

The volatile oil components of thyme have also been shown to have antimicrobial activity against a host of different bacteria and fungi. *Staphalococcus aureus*, *Bacillus subtilis*, *Escherichia coli* and *Shigella sonnei* are a few of the species against which thyme has been shown to have antibacterial activity.

For thousands of years, herbs and spices have been used to help preserve foods and protect them from microbial contamination, now research shows that both thyme and basil contain constituents that can both prevent contamination and decontaminate previously contaminated foods. In these studies, published in the February 2004 issue of *Food Microbiology*, researchers found that thyme essential oil was able to decontaminate lettuce inoculated wth *Shigella*, an infectious organism that triggers diarrhea and may cause significant intestinal damage. In addition, washing produce in solution containing either basil or thyme essential oil at the very low concentration of just 1% resulted in dropping the number of *Shigella* bacteria below the point at which they could be detected. While scientists use this research to try to develop natural food preservatives, it makes good sense to include thyme and basil in more of your recipes, particularly for foods that are not cooked such as salads.

Adding fresh thyme and/or basil to your next vinaigrette will not only enhance the flavor of your fresh greens, but will help ensure that the fresh produce you consume is safe to eat.(March 25, 2004)

A Nutrient-Dense Spice

The range of other health-supportive nutrients found in thyme is also impressive. This food emerged from our food ranking system as an excellent source of vitamin C, a very good source of vitamin A, and a good source of iron, manganese, copper, and dietary fiber.

Description

A delicate looking herb with a penetrating fragrance, thyme is an herb we should all take time to investigate and enjoy. And with about sixty different varieties including French (common) thyme, lemon thyme, orange thyme and silver thyme, this herb is sure to add some spice to your life.

Thyme leaves are curled, elliptically shaped and very small, measuring about one-eighth of an inch long and one-sixteenth of an inch wide. The upper leaf is green-grey in color on top, while the underside is a whitish color.

French thyme is known scientifically as *Thymus vulgaris*.

History

Thyme has been used since ancient times for its culinary, aromatic and medicinal properties. The ancient Egyptians used it as an embalming agent to preserve their deceased pharaohs.

In ancient Greece, thyme was widely used for its aromatic qualities, being burned as incense in sacred temples. Thyme was also a symbol of courage and admiration with the phrase "the smell of thyme" being a saying that reflected praise unto its subject. Thyme's association with bravery continued throughout medieval times when it was a ritual for women to give their knights a scarf that had a sprig of thyme placed over an embroidered bee. Since the 16th century, thyme oil has been used for its antiseptic properties, both as mouthwash and a topical application.

Thyme is native to areas such as Asia, southern Europe and the Mediterranean region and is also cultivated in North America.

How to Select and Store

Whenever possible, choose fresh thyme over the dried form of the herb since it is superior in flavor. The leaves of fresh thyme should look fresh and be a vibrant green-gray in color. They should be free from dark spots or yellowing.

Even through dried herbs and spices like thyme are widely available in supermarkets, you may want to explore the local spice stores in your area. Oftentimes, these stores feature an expansive selection of dried herbs and spices that are of superior quality and freshness compared to those offered in regular markets. Just like with other dried spices, when purchasing dried thyme, try to select that which is organically grown since this will give you more assurance that it has not been irradiated.

Fresh thyme should be stored in the refrigerator wrapped in a slightly damp paper towel. Dried thyme should be kept in a tightly sealed glass container in a cool, dark and dry place where it will keep fresh for about six months.

How to Enjoy

A Few Quick Serving Ideas

- Add thyme to your favorite pasta sauce recipe.
- Fresh thyme adds a wonderful fragrance to omelets and scrambled eggs.
- Hearty beans such as kidney beans, pinto beans and black beans taste exceptionally good when seasoned with thyme.
- When poaching fish, place some sprigs of thyme on top of the fish and in the poaching liquid.
- Season soups and stocks by adding fresh thyme.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Thyme, fresh
2.00 TBS
4.80 grams

Calories: 5
GI: very low

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
vitamin C	7.68 mg	10	38.0	excellent
iron	0.84 mg	5	17.3	good
manganese	0.08 mg	4	14.8	good
copper	0.03 mg	3	12.4	good
fiber	0.67 g	3	9.9	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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For education only, consult a healthcare practitioner for any health problems.
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Turmeric

What's New and Beneficial About Turmeric

- Despite its use in cooking for several thousand years, turmeric continues to surprise researchers in terms of its wide-ranging health benefits. While once focused on anti-inflammatory benefits, decreased cancer risk, and support of detoxification, studies on turmeric intake now include its potential for improving cognitive function, blood sugar balance, and kidney function, as well as lessening the degree of severity associated with certain forms of arthritis and certain digestive disorders.
- Use of turmeric in recipes can help retain the beta-carotene in certain foods. For example, one study has shown that the beta-carotene in carrots and pumpkins is better retained when those vegetables are cooked using recipes that include turmeric.
- Studies on satay—the very popular grilled meat dish that is often marinated in a spice mixture containing turmeric—have demonstrated a unique role for turmeric in providing health benefits. The grilling of meats is well-known for its potential to produce heterocyclic amines (HCAs) from protein substances in the meats. These HCAs are also well-known for posing potential health risks. Researchers now know that turmeric helps prevent formation of HCAs in grilled meat, including satay that has been marinated in a turmeric-containing spice mixture. About 1-2 teaspoons of turmeric per 3.5 ounces of meat was used to produce this helpful outcome in one study.
- Whole turmeric is likely to provide you with a different set of benefits than its best-studied constituent—namely, curcumin. That's because turmeric includes three different curcuminoids: curcumin, bisdemethoxycurcumin, and demethoxycurcumin. It also contains volatile oils like tumerone, atlantone, and zingiberone. These different substances are all associated with their own unique health benefits.
- The amount of turmeric that you need to receive health benefits is not a lot. While researchers are accustomed to looking at countries like India where intake of turmeric often reaches a level of 1-2 grams every day (2.2 grams of the turmeric powder that we profile on our website equates to one teaspoon), studies show potential health benefits at much lower amounts. In some situations, as little as 50 milligrams of turmeric over a period of several months have been linked with health benefits. This small amount would be the equivalent of approximately 1/50th of a teaspoon.

Turmeric, ground
2.00 tsp
(4.40 grams)

Calories: 16
GI: very low

Nutrient	DRI/DV
manganese	17%
iron	10%
vitamin B6	5%
fiber	4%
copper	3%
potassium	3%

Health Benefits

It's important to know that the vast majority of studies on turmeric have not examined the spice itself, but rather one of its constituents called curcumin. When you hear about the benefits of turmeric on a website or on a health news report on television, you are mostly likely hearing about the benefits of curcumin. This aspect of the health research can be very confusing!

On the one hand, curcumin is a polyphenol in turmeric with a quite remarkable set of potential health benefits. These potential benefits include better regulation of inflammation, oxidation, cell signaling, blood sugar levels, blood fat levels, and brain levels of the omega-3 fatty acid called DHA (docosahexaenoic acid), among its many benefits. But at the same time, there are many other health-supportive substances in turmeric, and the amount of curcumin in turmeric root can be fairly small. The actual amount of curcumin in turmeric varies from species to species, growing conditions, and timing of growth and harvest. But it typically accounts for only 2-5% of the root weight and can drop even lower under some conditions. In short, we are delighted to see great studies on the health benefits of curcumin, yet since we are most interested in the spice itself (turmeric) and the potential benefits of this spice in recipes, we also realize that some of the research on curcumin doesn't easily translate into these more practical kitchen and recipe applications. In the remainder of this Health Benefits section, we want to tell you about practical health benefits of turmeric in cooking based on our confidence in research about the spice itself.

Overall Decreased Cancer Risk

The vast majority of studies on turmeric and cancer risk have been conducted on rats and mice. In addition, the research interventions have involved curcumin rather than turmeric. Normally, we would not try to draw any conclusions about food and your health from animal studies on isolated food constituents! But in this case, we feel justified in making an exception due to the large number of animal studies, the consistency of the findings, and the diverse number of mechanisms that allow curcumin to lower cancer risk in rats and mice. These mechanisms include: antioxidant mechanisms, anti-inflammatory mechanisms, immuno-regulatory mechanisms, enzyme-related mechanisms, cell signaling mechanisms, and cell cycle mechanisms. As you can surmise, we're talking about a remarkable range of potential anti-cancer impacts with respect to curcumin intake.

In addition, animal studies on curcumin have looked at a wide variety of cancer forms, including cancer of the prostate, pancreas, lung, colon, cervix, breast, mouth, tongue, and stomach. At WHFoods, our research presentation policy is to avoid extrapolating from animal studies to human diets. We like to see large-scale studies on humans eating everyday foods before we post information on our website about the health benefits of particular foods. However, in this case we would like to make an exception. Even though we do not have large-scale studies on humans consuming turmeric, the repeatedly positive findings in these animal studies on curcumin convince us that you can lower your overall cancer risk through regular consumption of turmeric.

Of special interest in the cancer research on curcumin has been its well-documented role in detoxification. In animal studies, curcurmin has consistently been shown to stimulate Phase II detox activity. This phase of detoxification allows our cells to bind potential toxins together with other molecules so that they can be excreted from the body. As more and more potentially toxic substances get bound together with other molecules during Phase II processing, our risk of cancer development decreases. Research interest in curcumin and turmeric also extends into other components of detoxification, and we look forward to future studies that will help to clarify the unique role of this spice in cellular detoxification.

It's been especially interesting to follow research on curcumin and cancers of the digestive tract. This component of turmeric has a relatively low level of absorption from the digestive tract. Less absorption might logically sound like an unwanted event that would provide fewer health benefits. However, less absorption from the gut up into the body might also mean more curcumin remaining inside the digestive tract, allowing it to provide health benefits in that location. Studies have shown that curcumin is relatively stable at stomach pH (the unit of measurement for acidity) and this stability means that curcumin might be able to pass through the stomach and onward through our intestines intact. Several animal studies actually show this result to occur, and they also show curcumin's ability to influence cell signaling in our intestines. In animal studies, this influence on cell signaling in the lower digestive tract has been linked to improvement in inflammatory conditions like colitis. This same set of events is under active study with respect to other chronic bowel problems as well as colorectal cancer.

Cardiovascular Benefits

Inclusion of turmeric as a spice in a recipe can help regulate blood fat levels after a meal. Studies show that the activity of certain enzymes (including pancreatic lipase and phospholipase A2) can be inhibited by incorporation of turmeric into recipes, with a result of lower blood triglycerides following meal intake. In the studies that we have reviewed, turmeric was not used by itself, but together with other spices including ginger, garlic, black pepper, cinnamon, and clove. One particular interesting result in one study was the role of stress in altering turmeric benefits. In this study, lowered levels of blood triglycerides were only seen when study participants stayed relaxed following their turmeric-containing meals. However, if the participants became engaged in stressful activities after their meals, blood triglyceride levels were not reduced by the turmeric-containing meals.

The anti-inflammatory and antioxidant effects of curcumin have been associated with improved regulation of blood pressure and decreased risk of several types of cardiovascular disease in animals. There are also cholesterol-lowering studies in animals given supplemental curcumin, but the amounts of curcumin required to see results in these studies raise questions for us about the applicability of these studies to turmeric as a spice in recipes. That's because 500 milligrams of curcumin is a representative dose in these cholesterol studies as a whole, and that amount would require the intake of about 7 teaspoons of turmeric per day if the plant root used to produce the powdered and dried spice contained 5% curcumin by weight.

Other Benefits

In animal studies, increased interest has been shown in the potential for turmeric to improve chronic digestive health problems including Crohn's disease, ulcerative colitis, and inflammatory bowel disease. Most of the proposed mechanisms of actions in these studies involve changes in cell signaling and decreased production of pro-inflammatory cytokines.

Rheumatoid and other types of arthritis have also been active areas of animal study on curcumin. Once again, most of the science interest here has been in decreased production of pro-inflammatory messaging molecules.

Improved cognitive function has also been an area of increased research interest. Here one fascinating focus has been on the ability of curcumin to stimulate production of DHA (docosahexaenoic acid) from ALA (alpha-linolenic acid). Both ALA and DHA are omega-3 fatty acids with a wide range of proven health benefits, but DHA has been shown to be especially important in nervous system function both in the brain and throughout the body. (There is more DHA in the brain than any other single type of fatty acid, and when DHA circulates around our body, the brain receives a higher percentage of this fatty acid than any other single organ.)

A fairly large number of foods contain small to moderate amounts of ALA. However, it is more difficult to get significant amounts of pre-formed DHA from food. (The best sources of pre-formed DHA on our website are fish, especially salmon and sardines.) Fortunately, under the right circumstances, our bodies can make DHA from ALA using enzymes called desaturases and elongases. It's precisely these enzymes that curcumin can stimulate in their activity, increasing the likelihood of more DHA production—and along with it, improved brain function in areas especially reliant on DHA. Given this set of events, it has not been surprising to see more animal studies focusing on the ability of curcumin and turmeric to potentially improve chronic neurodegenerative problems including Alzheimer's disease.

Finally, as mentioned in our What's New and Beneficial section, use of turmeric as a recipe spice has been shown to lower loss of beta-carotene in certain cooked foods. The best study that we have seen in this area involved the use of turmeric in the cooking of carrots and pumpkin. Also studied were amaranth and the leaves of a vegetable commonly called drumstick (*Moringa oleifera*). It was the antioxidant properties of numerous compounds in turmeric that researchers pointed to as the mostly likely cause of better beta-carotene preservation.

Before leaving this Health Benefits section, it is worth noting that recent studies show the breakdown products of curcumin to be as potentially helpful as curcumin itself. These breakdown products include vanillin and ferulic acid—two well-studied antioxidant and anti-inflammatory compounds. The role of curcumin breakdown products puts even further emphasis on the unique potential for turmeric health benefits inside the digestive tract where this breakdown process would initially occur.

Description

The dried powdered spice that many people use in recipes comes from the root (rhizome) portion of the plant *Curcuma longa*. The unprocessed form of this root bears a strong resemblance to ginger root, and that resemblance is not a coincidence! Turmeric, ginger, and cardamom are plants all belonging to the *Zingiberaceae* family—also known as the ginger family. You'll sometimes hear turmeric being referred to as Indian saffron since its deep yellow-orange color is similar to that of saffron. You'll also sometimes hear it being referred to as curcuma, after it's best-studied polyphenolic component, namely, curcumin. Turmeric has been used throughout history as a culinary spice, herbal medicine, and fabric dye.

Turmeric root has a very interesting taste and aroma. Its flavor is peppery, warm, and bitter while its fragrance is mild yet slightly reminiscent of orange and ginger.

Consumers in the U.S. are mostly familiar with the dried, powdered form of turmeric and its unique and unforgettable color. When purchased in fresh root form, however, turmeric looks quite similar to ginger root, even though when cut open, its flesh is vibrant orange and dramatically different from the color of cut ginger root.

History

Turmeric is native to India and Southeast Asia, where it has been popular in cuisines for several thousand years. In addition to its culinary use, turmeric has remained a mainstay herb in botanical medicine, with medical usage going back thousands of years in the Ayurvedic tradition. In the U.S., turmeric is a substance that is included on the GRAS List (Generally Recognized As Safe) by the U.S. Food and Drug Administration where it is considered as a natural food coloring agent.

On a worldwide basis, about 800,000 tons of turmeric are produced each year, with over 75% of this total amount coming from India, which is also the world's largest consumer and exporter of turmeric; in terms of exports, over 50% of all global exports come from this country. After India, the greatest turmeric production currently occurs in Bangladesh, Pakistan, Sri Lanka, Taiwan, China, Myanmar, and Indonesia. Turmeric is also grown commercially in many Central and South American countries.

How to Select and Store

Even through dried herbs and spices are widely available in supermarkets, explore the local spice stores or ethnic markets in your area. Oftentimes, these stores feature an expansive selection of dried herbs and spices that are of superior quality and freshness than those offered in regular markets. Just like with other dried spices, try to select organically grown turmeric since this will give you more assurance that the dried, powdered herb has not been irradiated. Since the color of turmeric varies among varieties, it is not a strict criterion for quality.

We would also note that fresh turmeric root is also becoming more widely available to consumers. You'll usually find this form of turmeric in the produce section, sometimes near the ginger root. Many people report enjoying this form of turmeric in soups, salads, and dressings or marinades. If you bring this form of turmeric home from the grocery, it should be stored in the refrigerator.

Be sure not to confuse turmeric with curry. "Curry" is a very generalized name for spice combinations that typically contain turmeric alongside of numerous other spices. For example, a dried powdered curry powder may often contain turmeric, coriander, cumin, ginger, cardamom, cinnamon, and clove, along with other spices like nutmeg or fenugreek.

Dried turmeric powder should kept in a tightly sealed container in a cool, dark and dry place. And as mentioned earlier, fresh turmeric rhizome (root) should be kept in the refrigerator.

How to Enjoy

A Few Quick Serving Ideas

- Add turmeric to egg salad to give it an even bolder yellow color.
- Mix brown rice with raisins and cashews and season with turmeric, cumin and coriander.
- Although turmeric is generally a staple ingredient in curry powder, some people like to add a little extra of this spice when preparing curries. And turmeric doesn't have to only be used in curries. This spice is delicious on healthy sautéed apples, and healthy steamed cauliflower and/or green beans and onions. Or, for a creamy, flavor-rich, low-calorie dip, try mixing some turmeric and dried onion with a little omega-3-rich mayonnaise, salt and pepper. Serve with raw cauliflower, celery, sweet pepper, jicama and broccoli florets.
- Turmeric is a great spice to complement recipes that feature lentils.
- Give salad dressings an orange-yellow hue by adding some turmeric powder to them.
- For an especially delicious way to add more turmeric to your healthy way of eating, cut cauliflower florets in half and healthy sauté with a generous spoonful of turmeric for 5 minutes. Remove from the heat and toss with olive oil, salt and pepper to taste.

For some of our favorite recipes, click Recipes.

Safety

Nutritional Profile

Introduction to Food Rating System Chart

The following chart shows the nutrients for which this food is either an excellent, very good or good source. Next to the nutrient name you will find the following information: the amount of the nutrient that is included in the noted serving of this food; the %Daily Value (DV) that that amount represents (similar to other information presented in the website, this DV is calculated for 25-50 year old healthy woman); the nutrient density rating; and, the food's World's Healthiest Foods Rating. Underneath the chart is a table that summarizes how the ratings were devised. Read detailed information on our Food and Recipe Rating System.

Turmeric, ground **2.00 tsp** **4.40 grams**				**Calories: 16** **GI: very low**
Nutrient	**Amount**	**DRI/DV (%)**	**Nutrient Density**	**World's Healthiest Foods Rating**
manganese	0.34 mg	17	19.6	excellent
iron	1.82 mg	10	11.7	excellent
vitamin B6	0.08 mg	5	5.4	good

fiber	0.93 g	4	4.3	good
copper	0.03 mg	3	3.9	good
potassium	111.10 mg	3	3.7	good

World's Healthiest Foods Rating	Rule
excellent	DRI/DV>=75% OR Density>=7.6 AND DRI/DV>=10%
very good	DRI/DV>=50% OR Density>=3.4 AND DRI/DV>=5%
good	DRI/DV>=25% OR Density>=1.5 AND DRI/DV>=2.5%

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